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CONTENTS:

The Northeast Coast of Brazil in Ancient Cartography: DR. ORVILLE A. DERBY..... 681

Scientific Books:—

Gould's Biographic Clinics: DR. SOLOMON SOLIS COHEN 694

Scientific Journals and Articles..... 697

Societies and Academies:—

The National Academy of Sciences; New York Section of the American Chemical Society: DR. H. C. SHERMAN. *The Anthropological Society of Washington:* DR. WALTER HOUGH. *The Biological Society of Washington:* WILFRED H. OSGOOD..... 698

Discussion and Correspondence:—

The Titles of Papers: PROFESSOR CHARLES BASKERVILLE, F. A. B. *Marginal and Ridge Scales in Cephalaspis and Drepanaspis:* DR. C. R. EASTMAN..... 702

Special Articles:—

On the Feasibility of measuring Tides and Currents at Sea: R. A. HARRIS. *Sex Differences in the Sense of Time:* PROFESSOR ROBERT MACDOUGALL..... 704

The National Physical Laboratory..... 708

The Bermuda Biological Station for Research: PROFESSOR E. L. MARK and PROFESSOR C. L. BRISTOL 709

Scientific Notes and News..... 711

University and Educational News..... 712

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*THE NORTHEAST COAST OF BRAZIL IN ANCIENT CARTOGRAPHY.**

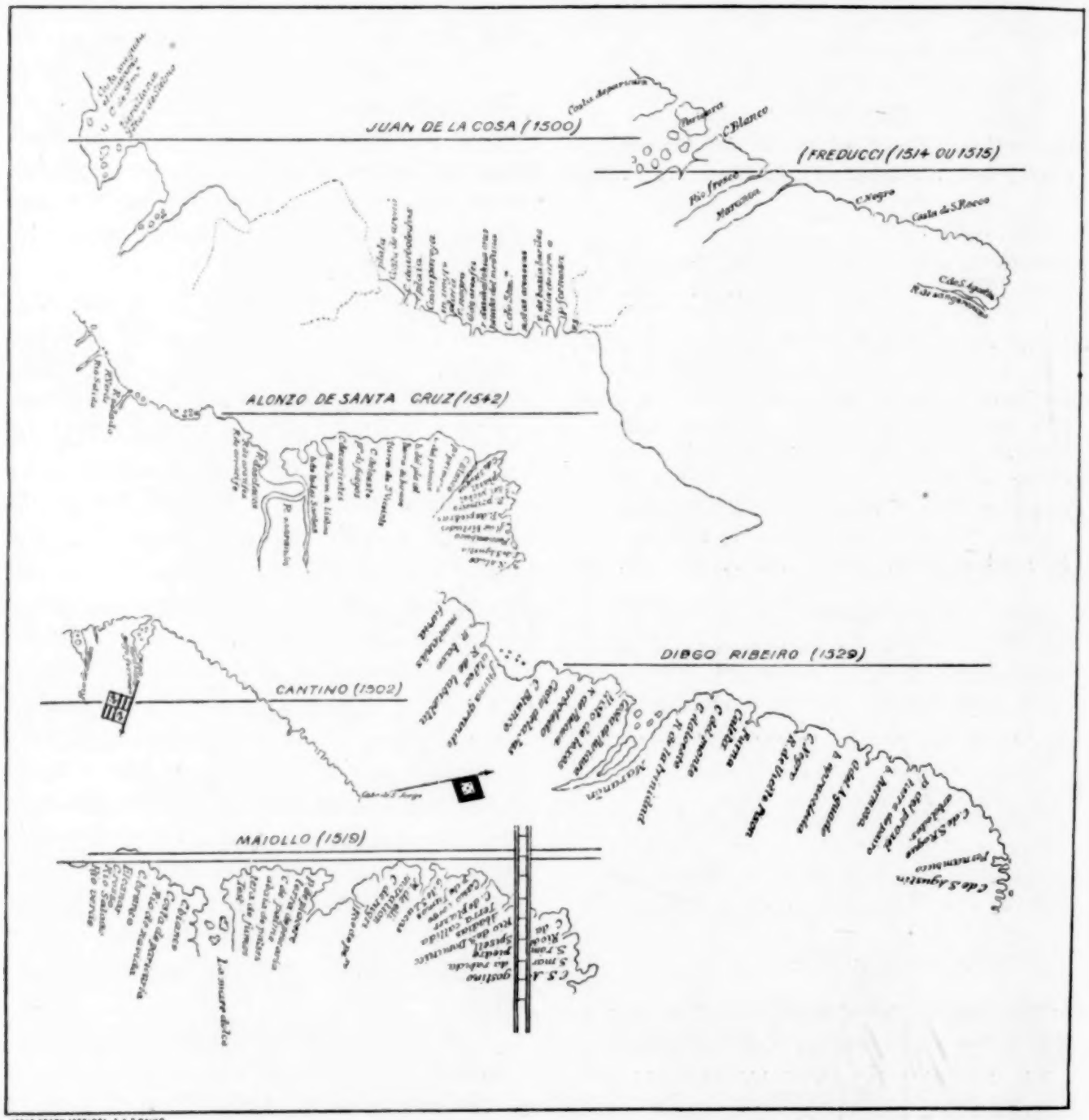
THE publication of the great atlas containing reproductions of almost all the known old maps of Brazil that accompanies the exposition of the Brazilian representative, Baron Rio Branco, to the arbitrator in the question of the limits of Guyana, makes possible, for the first time in Brazil, the study of the ancient cartography of that country. Having applied myself to this study in a recent paper entitled 'Os Mappas mais antigos do Brasil' published in Vol. VII. of the *Revista do Instituto Historico de São Paulo,* I verified the possibility of amplifying and correcting the scanty written documents relative to the first epoch of Brazilian history, and being invited by Baron Studart to contribute to the commemoration of the first settlement of the state of Ceará, it seemed to me that I could best respond to his intentions by making a similar study of the portion of the coast to which that state belongs. Both geographically and historically this portion is limited on the south by Cape Santo Agostinho and on the north by the mouth of the Amazonas, and to this section the present study will be exclusively devoted.

In the above-mentioned paper I treated summarily of this section in the analysis of the map of Juan de la Cosa of 1500 in which it was for the first time represented on the basis of the data furnished by the explorations of Vicente Yanez Pinzon and

* Translated from the memorial volume of the tricentennial of the state of Ceará, Brazil.

Diogo de Lepe, which were made in that same year. I now propose to make a more detailed study of this precious document and of the maps that followed it.

A careful examination of the map of Juan de la Cosa indicates that the author had detailed information regarding the section of the coast from a point a little to the west of Cape S. Roque to the mouth of the Orinoco, where his own observations, as a member of the expedition of Hojeda in 1499, commenced. The relatively accurate configuration of this section, the presence of names and the placing under the equator of the great indentation that undoubtedly represents the mouth of the Amazonas indicate with almost absolute certainty that this part of the map was copied from an older map (a prototype in the phrase of Harrisse) based on the observations of one or more of the first navigators that had coasted along it. The



point where this prototype commenced is clearly indicated by the beginning of the nomenclature in front of the figure of a Spanish ship, by the inscription referring to Pinzon and by the perfunctory character of the drawing to the southward of the bend of the coast that represents Cape S. Roque.

Judging exclusively by the map, one would say that the characteristic configuration of the coast in the neighborhood of this cape was recognized by one of the first discoverers, but that he only landed to the west of this point at the mouth of a river of which the name has been destroyed by a rent in the paper of the map. The first letter of this name is an *S*, which seems to indicate a denomination taken from the saints' calendar. Following comes a series of sixteen names to another rent in the paper, indicative of a detailed examination of the coast, to which was applied denominations that for the most part are simply descriptive. Amongst these the most significative is 'rio de sefallohuacruz' (river where a cross was found), which indicates that the author of the name was preceded by another christian. The only name of this series that is not descriptive is 'C^{o} de stm^{a}' (Cape Santa Maria), taken from the calendar and probably indicative of a date, and with regard to which it should be noted (as Harrisse has already observed) that it belongs to a group of names written in a different hand from that of the body of the map. Beyond this first series of names another rent in the paper, in a position that includes the gulf of Maranhão,* has perhaps destroyed some other names. Following comes a considerable stretch of coast without names but with a pronounced topographical feature in the drawing in the strong indentation of the coast line, that presumably represents the southern mouth of the Amazonas, or Rio Pará. Another indentation with a group of six names and placed under the equator undoubtedly represents the main mouth of the Amazonas designated by the names of 'g^{o} de Stm^{a}' (Gulf of Santa Maria) and 'elmacareo' (pororóca or bore).

The conclusion to be drawn from the study of the map is that this part of the coast was explored by two discoverers and afterwards represented by Juan de la Cosa on the basis of a prototype embodying the observations of one or the other, or both, of whom the second registered the finding of a cross set up by the first. These explorers, or one of them, seem to have sighted the coast near Cape S. Roque, so as to have perceived its inflexion to the south, but to have only landed to the west of this cape, and to have followed the coast closely throughout a certain section, noting and naming all its details, to afterwards sail farther out before landing again at the mouth of the Amazonas.

Another map almost contemporary with that of Juan de la Cosa and presumably based on the results of the same explorations is the one organized in Lisbon in the year 1502 by order of Albert Cantino. In the above-mentioned paper, in which the South American part of this map is reproduced, I presented reasons for believing that it was in great part compiled from information gathered from sailors in the port of Lisbon rather than from preexisting maps. Thus for the southern coast of Brazil there are indications of slightly detailed information relative to the Portuguese expedition of 1501, the author, on his own account, substituting the name 'Cape São Roque,' given by that expedition by 'Cape St. George,' probably in commemoration of the date of discovery of Brazil at Porto Seguro by Cabral.

* Maranhão, and Maranham are different modes of writing the same Portuguese word, the first form being the one usually employed in modern writings.

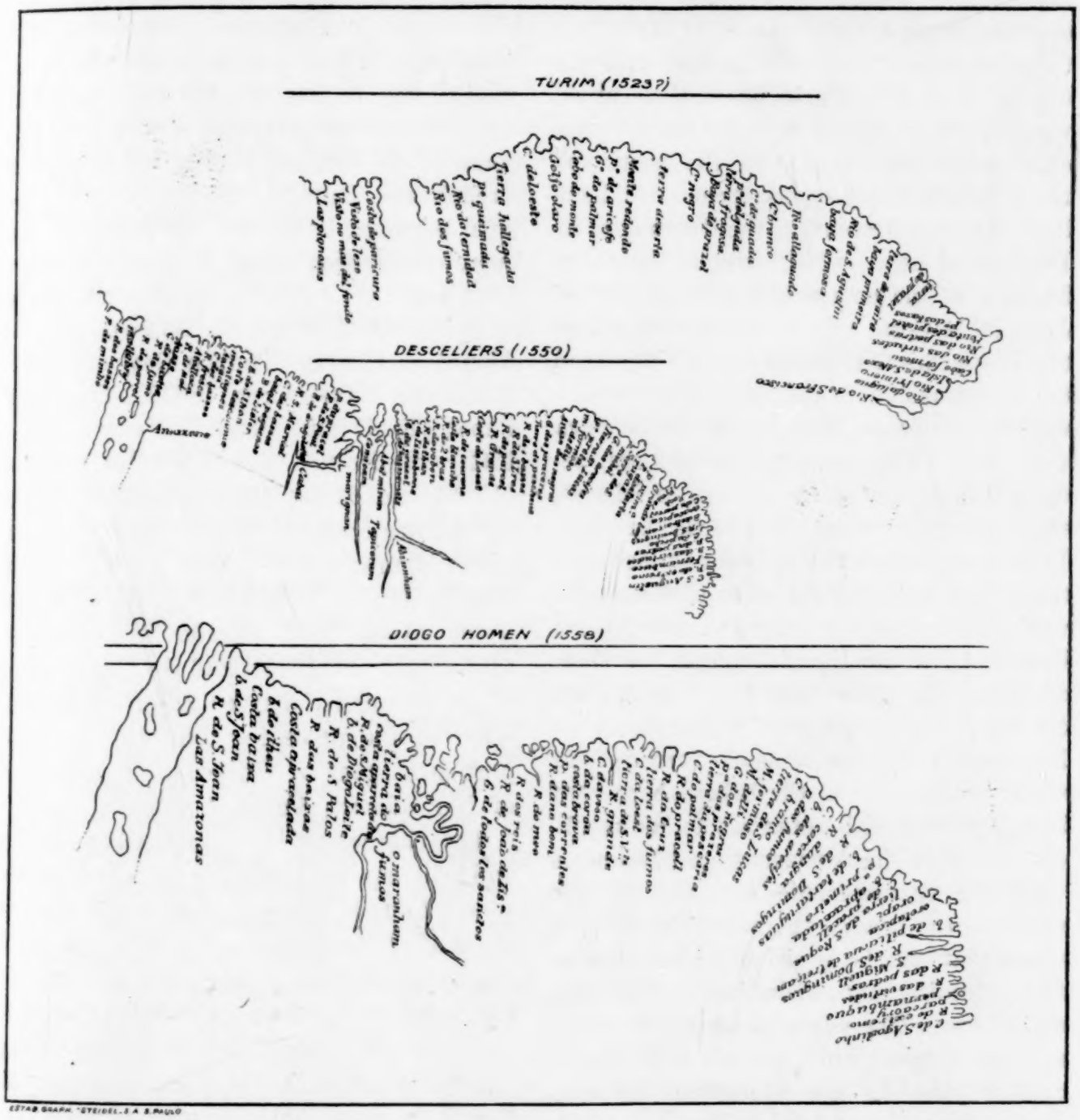
In the section here considered the Cantino map is without details and names, with the exception of two great gulfs which seem to represent that of Maranhão and the mouth of the Amazonas. The first bears the inscription 'Canabales. Golfo fermoso' (Canabals. Gulf fermoso), and the second that of 'rio grande' and, in front, 'todo este mar é agua doce' (all this sea is fresh water). From this it may be concluded that one of the explorers of 1500 entered the gulf of Maranhão and had here an encounter with the Indians.

In the configuration of the coast the Cantino map gives an almost northeast direction to the section between Cape S. Roque and the mouth of the Amazonas, thus throwing the latter far to the north of the equator. This defect reappears in many of the early maps, especially those printed in Germany, which evidently took this Cantino map, or some of its derivatives, as a prototype.

A new exploration of this coast is apparently indicated by the map reproduced in the text (p. 84) of Rio Branco's second memoir where it is attributed to Count Ottomano Freducci and to the year 1514 or 1515. For the section to the south of Cape S. Roque the prototype of this map was evidently a simplified copy of the Portuguese map of 1502, or some other one similar to it; and for the section to the north of the Amazonas, a Spanish map similar to those mentioned below of Maiollo, the Turin map or that of Diego Ribeiro, and which was not that of Juan de la Cosa. The intermediate section, however, presents special characteristics which may be either Portuguese or Spanish. Among the four names of this section 'c. negro' recalls the 'r. negro' and 'm. negro' of the Juan de la Cosa map, but 'maranon,' 'rio fresco,' 'c. blanco' and 'paricura' are entirely new. It is worthy of note that the topographical drawing, which is generally perfunctory, represents two rivers near the name Maranon and a large island dividing the mouth of the Amazonas, thus being in this respect remarkably accurate.

The Maiollo map of 1519 evidently had substantially the same prototypes as that of Freducci for the sections to the south of Cape S. Roque and to the north of the Amazonas, but another one for the section here considered. As its rich nomenclature is Italianized it is difficult to say if it was originally Portuguese or Spanish, but the use in two places of 'fumos' instead of 'humos' indicates the former. The extreme eastern point of the continent figures with the name of 'c. de spicell' (c. de S Miguel?), S. Roque ('s. rom' on the map) being placed to the southward of a new name 'Rio de piedre' which is probably the Rio Goyana. These new names of 'Cape S. Miguel' and 'Rio das Pedras,' which appear to the south of Cape S. Roque (like 'Pernambuco' and 'Rio das Virtudes,' which appeared almost simultaneously in maps of 1518 and 1523), probably come from Portuguese navigators who explored the southern part of the continent, those of the new prototype beginning to the west of the Cape Spicell of the map. Amongst these last are 'c. denigri' and 'maralion' that are probably identical with the 'c. negro' and 'maranon' of the Freducci map, though the latter name is placed to the eastward of the feature in the drawing that undoubtedly represents the gulf of Maranhão. Discharging into the latter is a 'Rio de pe[illegible]' which like 'cauo corco' is a significative name to which we shall return later. It is to be noted that in his later map of 1527 Maiollo emended the nomenclature of the coast between Cape S. Roque and the mouth of the Orenoco making it correspond almost exactly with that of the Freducci map, with which he had evidently become acquainted in this interval of time.

Another Italian map known by the name of 'The Turin Map,' and attributed to the year 1523, bears a rich nomenclature different from that of those above mentioned, and one most decidedly of Portuguese origin. Amongst the 24 names in the section in question only two (c. negro and rio dos fumos) present similarity with those of the Maiollo map. The topographical drawing is perfunctory, the gulf of Maranhão being indicated only by a slight indentation with the name of 'Golfo Claro,' while the mouth of the Amazonas is without special denomination, though clearly indicated in the drawing, and with the characteristic name of 'Costa de paricura' in the northern margin.



The map of Diego Ribeiro, Royal Cosmographer of Spain, of 1529, bears the express declaration that the coast between the Rio Dulco (Orinoco) and Cape S. Roque contains nothing of profit, and that having

been coasted along once or twice soon after the discovery of the Indias (America), no one returned to it. This declaration indicates that in the official Spanish department (Casa de la Contratacion of Seville) especially charged with the gathering of information regarding voyages and discoveries, maps already known in Italy, like those on which Freducci, Maiollo and the author of that of Turin based their work, were either unknown or overlooked. According to this declaration the prototype for the section here considered must have been a map representing the discoveries of Pinzon and Lepe, but differing in the drawing and in the nomenclature from that of Juan de la Cosa. On a comparison of the two it appears that Diego Ribeiro identified the Amazonas (with the name of Maranon) with the first great indentation, or Rio Pará (?) of the map of Juan de la Cosa, reducing the second to a bay full of islands, and with the name of 'furna grande.' Thus is explained the erroneous placing of the mouth of the great river to the southward of the equator, which persisted for a long time in the Spanish maps (or those derived from them) and introduced great confusion in geography. The gulf of Maranhão (with the name of 'furna') is of slight prominence in the Ribeiro map, but is well placed with reference to the southern mouth of the Amazonas, and is figured with the characteristic entrance of two rivers at the head. 'C. negro' is the only name that can be positively identified on any preceding map, including that of Juan de la Cosa. The name 'R. de uicête pison' appears to be an interpolation made by the cartographer in his prototype, in commemoration of the first discoverer. Other map-makers, commencing with Freducci, made a similar interpolation, but in the section to the north of the Amazonas, and this use prevailed, giving as a result the well-known complication of the Oyapock question between Brazil and France. The absence in this map of characteristic Pinzonian names is a notable fact which perhaps indicates that its prototype was based principally on the voyage of Lepe.

The maps that succeeded that of Diego Ribeiro, commencing with one dated 1534, indicate the introduction, for the section in question, of a new prototype of Portuguese origin; and it is a notable fact that this served for many years as a prototype for maps of all origins, Portuguese, Spanish, French and Dutch. This new prototype must therefore have been based on a Portuguese exploration made between the years 1529 and 1534. The original maps based on this prototype are the Spanish ones of Alonzo de Chaves (Padron Real of 1536), Alonzo de Santa Cruz (1542), Sebastian Cabot (1544) and Diego Gutierrez (1550, 1562); the French ones of Nicolas Desliens (1541) and Pierre Desceliers (1550); the Portuguese ones of Gaspar Viegas (1534), Diogo Homen (1558, 1568), André Homen (1559), Lazaro Luiz (1563), Bartholemeu Velho (1564) and Fernão Vaz Dourado (1568, 1571 and 1580), and the Dutch maps in great number derived from one or another of the preceding, but for the most part from that of Gutierrez of 1562 and of Bartholemeu Velho of 1564.

The characteristic of this prototype by which it can be identified in all of its reproductions is the topographical design of the gulf of Maranhão and of the rivers that discharge into it. The nomenclature is characterized by the preservation of a good part of the names of the Maiollo map (probably indicating that the explorer followed the coast with this map, or a derivative from it, in hand) and by the introduction of many new Portuguese names, amongst which that of Diogo Leite is especially significant, as it may be presumed to be that of the explorer himself.

Not having at hand the oldest of these maps (that of Gaspar Viegas of 1534*), we take as presumably the most complete and accurate of the reproductions of this prototype, that of Diogo Homen for the nomenclature, and of Pierre Desceliers for the topographical design of the neighborhood of Maranhão. This last map is also interesting as showing that notwithstanding its date posterior to the voyage of Orellana down the Amazonas, the drawing was made before this event, the river being interpolated (and erroneously) in a design that figured a continuous coast line to the northward of the gulf of Maranhão. The same interpolation, but more artfully made, is to be noted in the Desliens map, while Alonzo de Santa Cruz (and undoubtedly also Alonzo de Chaves in his lost Padron Real), not knowing the Amazonas of Orellana, adjusted the new prototype to the old maps by suppressing the Amazonas and identifying the 'Rio de la Mar Dulce' of Pinzon (to which the Spaniards had applied the name of 'Maranon') with the gulf of Maranhão of the Italian cartographers and of the new Portuguese explorer. Other Spanish cartographers (Cabot and Gutierrez) resolved the difficulty by hashing the drawing and nomenclature of the new prototype to the west of Maranhão. From this resulted the confusion and discordance of the early maps that figured so largely in the discussion of the limits between Brazilian and French Guyana, without their origin being discovered on account of the loss of the Padron Real of Alonzo de Chaves from which they proceeded. The recent publication in Sweden of the map of Alonzo de Santa Cruz, which is essentially a reproduction of the Padron Real, clears up the matter perfectly, showing that in a group of maps antedating the voyage of Orellana there was a total suppression of the Amazonas, which had afterwards to be restored confusedly.

In view of the circumstances above indicated we have selected for reproduction the maps of Diogo Homen, Desceliers and Alonzo de Santa Cruz. The others give more or less diversified variances of the same theme.

In studying this prototype one is impressed with the relatively minute and accurate representation of the hydrography of the basin of the gulf of Maranhão (far superior, for example, to the representation given by the famous Sebastian Cabot to the River Plate basin where he had been for four years), and by the introduction of a group of Indian names of which some (Itapicurú and Pindaré) have been preserved to the present day. This seems to indicate that the explorer found here an European domiciled amongst the Indians and well acquainted with the topographical details of the region. This supposition is, to a certain extent, confirmed by the fact that the only other indigenous names are found grouped between Pernambuco and Cape S. Roque, where the Europeans had been for some years in contact with the Indians so as to have become somewhat acquainted with their language.

The topographic design of the reproductions of this prototype in the maps of Diogo Homen and Desceliers is sufficiently detailed to permit the identification of some of the more salient features, and, based upon these, we can attempt that of the names as follows, taking them from the

* This map preserved in the National Library of Paris is, according to the note by Harrisse (*op. cit.*, p. 599), a nautical chart representing, in the Brazilian part, the coast from two or three degrees to the west of Maranhão to about two degrees to the south of the La Plata estuary. With reference to it Ferdinand Diniz (cited by Harrisse) says: "Captain Mouchez who had been charged by the French government with the continuation and improvement of the work of Admiral Roussin (the marine chart of the coast of Brazil) was like myself astonished by the relative accuracy of this geographical monument."

map of Diogo Homen which best preserves their original Portuguese form:

C. de S. Agostinho.—This name originated with the Portuguese expedition of 1501, which also used the name of 'C. da Santa Cruz' for the same feature.

Parcarohy.

R. do Extremo.—On the plausible hypothesis that the 'Pernambuco' of the map was situated to the north of the present city, this would be the river Capibaribe.

Pernambuquo.—This name in the form 'Pernambua' appeared for the first time in a Portuguese map referred to the year 1518.

R. das Virtudes.—Probably the canal of Itamaracá.

R. das Pedras.—Rio Goyana. This name appears for the first time in the Maiollo map of 1519, but dislocated to the north. Sebastian Cabot went, in 1526, from Pernambuco to the Rio das Pedras to take water, passing by the Rio das Virtudes, which apparently was not suitable for the purpose. This last name appears in the Turin map of 1523.

S. Miguell.—Another map by Diogo Homen, dated in the same year, has instead 'c. de spicell,' which had already appeared in the maps of Maiollo and of Turin. This seems to be Cape Branco to the south of Parahyba.

R. de S. Dominguos.—Rio Parahyba.

B. de Pitiacua de treicam.—Bahia da Traição (Bay of the Ambuscade). The name probably refers to some historical event before 1534, as it appears in the Chaves map in the form of 'Epitiaca,' and in that of Viegas as 'b. da treiçam.' The name is generally attributed to an event that took place in 1556, but erroneously, as these maps prove.

Orotapica, Orapi.—These two names in the vicinity of the city of Natal (Rio Grande do Norte) are the last of a group of Indian names that extend from the Cape S. Agostinho, and probably indicate that to this point extended the more or less friendly relations of the whites with the Indians.

Tierra de S. Roque.—In the vicinity of the cape of the same name.

C. do Parcell.—Probably the Cape Calcanhar, the extreme point of the continent.

B. Apracelada.—(The bay of reefs.)

Pª. Primeira.—(The first point.)

B. de Tartarugas.—(Turtle Bay.) Bahia de Aguamaré (?) The Desceliers map has 'Grande baya' but before the Ponta Primeira.

R. de S. Domingos.—Rio Açú (?)

R. Dangra.—Rio Mossoró (?)

C. Corco.—This name appears first in the Maiollo map of 1519 and continues to that of Brué of 1834, where it is identified with the Ponta do Retiro Grande between the mouths of the Mossoró and Jaguaribe. The Desceliers map gives here 'Serres de S. Michel,' a name that persisted until after the Dutch invasion.

R. dos Arecifes.—(River of Reefs.)

R. dos Fumos.—(Smoke River.) This name appears in the Maiollo map. It is probably on the coast of Aracaty in Ceará.

C. Branco.—Ponta de Mucuripe (?)

Tierras de S. Lucas.—Vicinity of Fortaleza (or Ceará) (?) The name is applied to a gulf in the Maiollo map.

M. Fermoso.

M. Delli.—The other map of the same year by Diogo Homen gives 'M. dely'; Maiollo, 'M. de elli.' It is probably the Serra de Mamamguape which, though situated in the interior, is an imposing feature of this part of the coast. Maiollo places close by the name 'Maralion.'

G. dos Negros.—Gulf of Ceará (?). This is in the region of the 'r. negro' and 'm. negro' of the Juan de la Cosa map. The 'C. Negri' of Maiollo and the 'c. negro' of the maps of Freducci, Turin and Diego

Ribeiro appear to be more to the west in the neighborhood of the river Parnahyba.

P.ª. dos Prazeres.—(Point of Pleasures.)

Tierra da Pescaria.—(Fishing grounds.)

C. do Palmar.—(Cape of the Palm Groves.)

R. do Pracell.—(River of the Reef.) Rio Acaracú (?)

R. da Cruz.—(River of the Cross.) This name appears to be preserved to the present day for one of the rivers discharging into the bay of Camocim. It is probably the 'R. das 3 bras' of the Desceliers map, although this name comes before the 'R. do pracell.'

Tierra dos Fumos.—(Land of Smoke.)

C. da Loest.—(East (?) Cape.)

Tierra de S. Vte.—(S. Vincent's Land.)

R. Grande.—Rio Parnahyba.

C. Daviso.—(Advise Cape.)

B. da Coroa.—(Bay of the Sandbank.) Bahia de Tutoya (?).

Costa Brava.—(Wild Coast.) 'Coste blanche' on the Desceliers map. Costa dos Lençoes.

P. das Correntes.—(Point of the Currents.) Ponta Mangaes Verdes.

R. Danobom.—(Rio de Anno Bom = New Year's River.) The Desceliers map gives 'R. de vobom'; Chaves and other Spanish maps, 'R. de Naubom.'

R. do Meo.—(Middle River.)

R. dos Reis.—(River of the Kings.)

R. do João de Lis.ª—(John of Lisbon's River.) Rio Piria (?), or perhaps the Rio Monim.

G. de Todos os Sanctos.—(All Saints' Gulf.) Bahia de São José, southern part of the Gulf of Maranhão.

O. Maranham.—Almost all of the old maps employ the name in this manner with the article *o* or simply without any qualifying term.*

Abatimirim.—This and the four following names come in the Desceliers map, but not in that of Diogo Homen.

Tapicoram.—Itapicurú (river).

Abiunham.—This name also appears in the map of Bartholomeu Velho where it seems to be applied to the river Parnahyba.

Camicam.—The other Diogo Homen map gives 'Acencam' (Ascension).

Cabai.—On an affluent of a river without name that represents the Grajanú. This affluent represents very well the river Pindaré, and the name 'Pinare' appears in the Gaspar Viegas map of 1534 and in the anonymous map of the Riccardiana Library.

Baia.—(Bay.) On the northern margin of the Gulf of Maranhão. On the Diogo Homen map of 1568 the name is 'b. grelo' or 'b. grela.' In the same position Vaz Dourado has 'Almadias.' It is at present known as the Bay of Itacolumy.

Tierra dos Fumos.—(Land of Smokes.)

Costa Aparcellada.—(Coast full of reefs.)

R. de S. Miguel.—'R. de S. Paul' on the Desceliers map. Rio Turyassú.

B. de Diogo Leite.—Bay of Turyassú. It is probable that the name is that of the commander of the exploring expedition.

R. de S. Palos.—'R. S. Marcial' on the Desceliers map. Rio Maracassumé.

R. das Baixas.—(River of the Shoals.) Rio Gurupy.

Costa Apracellada.—The other map of Diogo Homen of 1558 has here 'p.ª da costa suja' (Point of the Dirty Coast), which comes from the Viegas map of 1534 and is reproduced in many of the old maps.

* This manner of using the name is very suggestive of a topographical term. The Portuguese language has in its marine topographical terminology the term 'o marachão' (an artificial or natural barrier of sand or gravel) which would be very applicable to this section of the coast and which might readily be transformed into 'o maranhão.' In fact the dictionary of Moraes cites an old author who gives (by error, says the lexicographer) 'maranhões' for 'marachões.'

B. de Ilheu.—(Bay of the Islander, or native of the Azores.)

Costa Baixa.—(Low Coast.)

B. de S. Joan.—Bahia da Bragança (?).

Costa Descoberta.—(Open Coast.) This name, which comes on the other map of Diogo Homen, is given as 'Coste desconnue' on that of Desceliers.

B. de S. Joan das Amazonas.—Rio Pará or southern mouth of the Amazonas. The last part of the name is evidently an interpolation after the voyage of Orellana. At this point the Desceliers map emends the new Portuguese prototype with an old Spanish map eliminating the Amazonas and the nomenclature of this prototype to the mountains to the north of the Oyapock. A similar elimination occurs in the maps of Alonzo de Chaves and Alonzo de Santa Cruz.

To the north of the mouth of the Amazonas the Diogo Homen map has the old nomenclature of the Spanish maps mixed with some new names (B. de muchas ishas, R. de Nuno and R. del Casique), which indicate a new exploration of this part of the coast. As these names appear in the map of the Riccardian Library this exploration must have been before the year 1543.

Combining the deductions that can be legitimately drawn from the study of these maps with the scanty data of the written history, we may now attempt a restoration of the story of the discovery and delineation of this portion of the coast. For this purpose we shall make use, as regards the historical data, principally of that carefully collected and verified by Harrisse in his great work entitled ' The Discovery of North America.'

Vicente Yanez Pinzon, setting out from Spain towards the end of 1499, sighted a cape, which he denominated 'Santa Maria de la Consolacion,' towards the end of January (20th or 26th, according to the chroniclers; 2d of February if the name indicates a date) of 1500. A few days afterwards he landed and executed acts of possession, including the planting of a cross on a point that he denominated 'Rostro Hermoso,' perhaps for being on the 4th of February, feast of the Veronica which in an old Spanish calendar is denominated 'Rostro Hermoso.' Continuing his voyage, Pinzon entered the mouth of the Amazonas, which he called 'Santa Maria de la Mar Dulce,' probably on account of being here on the 25th of March, feast of the Annunciation. Entering a few leagues in the great river, which he called 'Marina tãbalo,'* he had an encounter with the Indians. Continuing to the northward, he gave the name of 'S. Vicente' to a cape which he probably passed on the 4th of April, and arrived at Hespaniola on the 23d of June and at Palos in Spain on the 30th of September.

The Cape Santa Maria of Pinzon should be relatively well placed on the Juan de la Cosa map, and in this case it must be some promontory to the west of Cape S. Roque on the coast of the present states of Rio Grande do Norte or Ceará, his Rostro Hermoso being some leagues farther on. Varnhagen quite plausibly identified Cape Santa Maria with the Ponta do Mucoripe and the Rostro Hermoso with the Ponta Jericoá-coára.

Diego de Lepe, starting from Spain shortly after Pinzon, took the same course and sighted the land at about the same point, whence steering eastward, he coasted along until he perceived the southward bend of the coast in the vicinity of Cape S. Roque, but, notwithstanding the affirmation in 1513 of his companions to the contrary, did not double the cape. Turning about, he landed at the mouth of a river that he named 'S. Julian,' which is per-

* May not this be a reference to the pororóca (bore), Marina tãbalo being a corruption of 'Marina-tambales' (Agitated sea)?

haps the partially destroyed name on the Juan de la Cosa map that commences with the letter *s*. Continuing westward, Lepe found the cross left by Pinzon, and entering the gulf of Maranhão, found the Indians there to be cannibals (see the Cantino map), perhaps through the loss of some companions, of whom one probably remained alive amongst the savages. Afterwards, leaving the coast so as no longer to be able to see and name its details, he entered the mouth of the Rio Pará and of the Amazonas proper, and, coasting northward, met Pinzon in the gulf of Paria. Before the 9th of November of 1500 Lepe had returned to Spain, but, as it appears, the greater part of his crew had returned some months before. Two of Lepe's companions, and perhaps the whole expedition, were in Hespaniola in February or March of 1500, where they met Juan de la Cosa, who was in the expedition of Hojeda.

Juan de la Cosa, being in Spain between the months of June and October of 1500 in the interval of two voyages, organized his celebrated map, or more probably contributed the American part to a map already made (in another style and with more elaborate ornamentation) by others, in the parts relating to the other continents. As Pinzon only arrived in Spain towards the end of September, it is almost certain that the section of the coast to the south of the Orinoco was drawn from data furnished by the companions of Lepe who had arrived in June without their commander. Thus, as has already been deduced above from the internal evidence of the map itself, it is probable that this map represents essentially the configuration and nomenclature given by Lepe, and probably communicated by one of his companions. In this way is explained the absence in the map of the names 'Santa Maria de la Consolacion, Rostro Hermoso, Santa Maria de la Mar Dulce, Rio Marina-tâbalo and Cabo San Vicente,' which in the following year were employed in the Capitulacion Real to designate the concession given to Pinzon, and which, being undoubtedly furnished by him as characteristic of his discovery, should necessarily figure in any map directly inspired by him. It seems probable, however, that the two names of 'Santa Maria' indicate a revision of the map by some companion of Pinzon. In view of the abbreviated form of these two names and the complete lack of the others, it is hardly probable that their interpolation in the map, already almost completed, was due to Pinzon himself.

In 1508 Pinzon, in company with Juan de Solis, again ran over this same coast, or at least a part of it, but in the contrary direction. In the combined notes of the two voyages furnished to Peter Martyr de Anghiera and published by him in 1511 in the first edition of his Decades, a few Indian names appear, and amongst these, in the section here studied, those of 'Paricura'* and 'Camamóro' applied to the two margins of the Amazonas.

It is to be noted that Peter Martyr only employed the name 'Maranon' in his writings of 1516 after it had been pronounced by two of Lepe's companions in the Diego Columbus suit of 1513. Owing to the incomplete state of the Juan de la Cosa map, which has a large rent in the place where the gulf of Maranhão should appear, it is impossible to say whether this name originated with the expedition of Lepe, or

* Caetano da Silva ('L'Oyapoc et l'Amazone,' Vol. II., p. 381, in the Rio Branco edition) cites Baena as authority for the existence of a tribe of Indians with this name to the north of the mouth of the Amazonas. Being published in 1511 and in a work that was doubtless eagerly consulted by all cartographers, the name Paracura appeared at once in the maps and became characteristic for the Amazonian region; it seems strange that its companion Camamóro should not have had the same good fortune.

if it was only current among sailors, having originated with some other expedition (presumably Portuguese) of which no historical notice has been preserved. The almost constant practice of the old map-makers of employing the name with the article, or without any qualifying term (*O* Maranham, or simply Maranham or Maranon) is very suggestive of a topographical term, such as, for example, 'O Porto,' 'El Farallan,' etc. The Portuguese marine terminology has 'O Marachão,' which would be very applicable to this part of the coast full of shoals and bars, and, as already noted, this name might easily be transformed into 'Maranhão' amongst people of slight literary culture.

The above-mentioned hypothesis of another expedition seems the most plausible one. The letter of Estevão Froes* written from San Domingoes on the 30th of July of 1514 after a year's imprisonment subsequent to a voyage along this coast, mentions João Coelho, 'he of the gate of the cross, residente of the city of Lisbon,' and Diego Ribeiro as his predecessors in this navigation. The name 'João de Lisboa' which appears in the second group of maps above analyzed seems to commemorate the first of these navigators, and in this case it may be presumed that it was furnished by some member of the expedition that had remained in the vicinity of Maranhão, and that another member of the same, passing to Italy, may have furnished the information on which the relatively detailed and accurate representation of this vicinity in the Freducci map of 1514 (?) was based.

In the suit of 1513 the pilot Andreas de Morales declared that he had made a map of this coast based on the information of Pinzon and Lepe. It is probable that this map (or another organized in the same condition and preserved in the Casa de la Contratacion of Seville) served as a prototype for the Diego Ribeiro map of 1529, notwithstanding that this does not show evident signs of having proceeded directly from either of these first expeditions.

In the same suit Pinzon identified his Cabo Santa Maria de la Consolacion with the Cape Santo Agostinho of the Portuguese navigators, but it is evident that here he either deceived himself, or sought to deceive others. It is possible that through another error of identification on the part of other witnesses of the same suit, the name 'Maranon' was applied to the Mar de Agua Dulce (or Amazonas) of Pinzon, since, judging from the Freducci and Maiollo maps, this name seems to have an origin independent of the expeditions of Pinzon and Lepe.

According to the terms of the above mentioned letter of Estevão Froes, his voyage was made in the year 1513 and in company with Francisco and Pero Corso, and at some point of the coast there was a hostile encounter with the Indians with whom was a certain Pero Galego (Pedro de Galicia). The name 'Corso' given to a cape in the Maiollo map seems to indicate information obtained from some member of this expedition, and, this being the case, it may be presumed that the name 'Rio Pero' in the same map refers to the Pero Galego of the letter. On this hypothesis this person must have been located in the vicinity of the gulf of Maranhão, having probably been left there by some of the preceding expeditions.

Another Portuguese navigator skirting the coast some time before 1523 applied to it a great many new names which in some way came to the knowledge of an Italian cartographer, author of the so-called Turin

* Cited by Varnhagen and given in full by Capistrano de Abreu in the pamphlet entitled 'Descobrimento do Brazil e o seu desenvolvimento no seculo XVI.' published in Rio de Janeiro in 1883. The name 'Fernão' given in this pamphlet was corrected to 'Estevão' in the recent work by the same author published in the volume of the fourteenth centennial of Brazil.

map. The fact is not referred to in the written history, and as the names remained limited to this map, which only became known within the last few years, this voyage did not constitute a notable permanent contribution to the knowledge of the geography of the region.

In 1527 an anonymous cartographer of the Casa de la Contratacion of Seville (probably Diego Ribeiro, author of the very similar map of 1529) organized a map in which the northeast coast was represented according to the data registered in that department, which, according to the express declaration of Diego Ribeiro in his map of 1529, was derived exclusively from the voyages of Pinzon and Lepe. In this map, as in that of 1529, the Amazonas is figured in a position that corresponds better with the southern mouth (or Rio Pará) than with the northern one, which is reduced to a simple bay with the name of 'Furna Grande,' although its proper position under the equator, as in the map of Juan de la Cosa, is preserved. To the great river thus dislocated to the southward was applied the name of 'Maranhom' in the 1527 map, and that of 'Maranon' in that of 1529, the first form being very suggestive of a Portuguese origin. In both these maps the gulf of Maranhão with its characteristic bifid inner-extremity is figured in its proper position with the name of 'Furna.'

In 1531, according to the investigations of Varnhagen ('Historia geral do Brazil,' 2d ed., I., p. 117) Diogo Leite, a Portuguese official, explored the coast between Pernambuco and the southern mouth of the Amazonas, and it is probable that to this explorer should be attributed the new type of map which, as we have already seen, appeared between the years of 1529 and 1534. Whoever may have been the author of this work, it is certain that between these dates an entirely new and very meritorious topographical survey of this part of the coast was made, and by a person who from previous maps took only the nomenclature of that of Maiollo, or of some other one very similar to it. It is equally certain that this explorer remained long enough in the vicinity of Maranhão to recognize and represent in a truly admirable manner its leading topographical features and to learn various indigenous denominations; or, which is more probable, a person was here met with who through long residence was able to furnish this information. The 'Pero Galego' mentioned by Estevão Froes, if still alive, would be in these conditions, and the hypothesis is not a very risky one that he was the informant. Whoever it may have been, somebody before 1534 furnished the cartographers* with elements for representing the hydrographic basin of Maranhão in a manner that presents a notable contrast with the grotesque representations of those of the River Plate and Amazonas based on the exploration of a Sebastian Cabot and of an Orellana.

The unfortunate attempt of Ayres da Cunha in 1536–38 to found a colony in Maranhão left no traces in the cartography of the region, unless the name 'Ascençao' in the maps of Diogo Homen and Desceliers is an interpolation in their prototype of a denomination given by this expedition. In the written history, however, the name given to the ephemeral settlement is 'Nazareth.'

About 1560 the cartographers commenced to attempt a representation of the interior of the continent, supplying the lack of definite data by flights of the imagination. Diego Gutierrez figured a great river uniting, across the continent, Lake Titicaca with the gulf of Maranhão and thus duplicating the

* Some of the maps made after this expedition differ somewhat in the drawing and in some of the names, from the earliest one preserved (that of Gaspar Viegas of 1534), and it is probable that there was another Portuguese prototype that has not come down to us.

Amazonas of Orellana; Bartholemeu Velho, in his map of 1464, represented a great central lake (Eupana) from which flowed to the south the Paraguay, to the north and entering the Amazonas the 'Paraa' (thus representing quite well the Tocantins), and to the east two rivers entering the São Francisco (quite well figured but united to the Paraná) which bifurcated to the coast of Maranh o by the river 'Abiunhao' (Parnahyba) and to that of Sergipe by the river 'Real.' This last feature persisted in maps until 1700.

The Gutierrez map, printed in Amsterdam in 1562, had an enormous recuperation and served as a prototype for a flood of maps characterized by a double Amazonas, published by the great Dutch printing firms of Ortelius, Mercator, etc. The equally bold conception of Bartholemeu Velho (reproduced, as regards the hydrography, by Vaz Dourado) had a somewhat more delayed entrance in current cartography, in which it was introduced in 1585 by Jan van Doet, whose map is essentially a reproduction of that of Bartholemeu Velho, of which the original only recently became known. These two types of maps, reproduced and modified *ad infinitum*, dominated cartography until 1625, when Jean de Laet, in the first edition of his great work on the New World, made a radical reform, introducing, on the basis of Portuguese marine charts and of Dutch explorations, the configuration which, improved but not essentially modified, has persisted till to-day. This last group of maps offers an interesting subject for study, for which, however, I have not the elements at hand.

Orville A. Derby.

São Paulo, Brazil,
June, 1903.

SCIENTIFIC BOOKS.

GOULD'S BIOGRAPHIC CLINICS.

Medical teaching has always been essentially demonstrative; and in modern days the facilities for bedside or 'clinical' instruction have been enormously enlarged. No instructor, however, has ever before gathered so distinguished an array of 'subjects' as Dr. George M. Gould brings before his world-class to illustrate his lectures upon 'Eye-strain.'* For it is in the irritation of nerve centers as a result of the accommodational strain necessitated by the attempt to use faulty visual apparatus in work requiring delicate adjustment and continuous effort, that this eminent lexicographer and ophthalmologist finds the ready explanation of the physical miseries of the great students, artists and writers whose pathologic life-history he studies. Certain common factors are found in these histories, not the least important of which are the early development and long persistence of the symptoms, their recurrence whenever the sufferer used the eyes in work or study, their resistance to all sorts of treatment, their relief when enforced rest from work gave unwitting deliverance from their cause and, finally, in those who survived to that period of life, their sudden disappearance, when accommodational effort ceased to be possible. The 'mysteriousness' which the symptoms seemed to assume both to patients and to physicians, is also a point well worth noting. To quote Dr. Gould's own words: "This lack of cause or reason for their sufferings struck each one, and pages of excerpts might be gathered showing their wonder. An unseen malignant enemy or fatality seemed seated above them or at the very heart of their being, implacable and unexplainable. To their physicians they turned with beseeching question, and imploring aid. Some spent a great part of their lives in going from one doctor to another, or in testing quackery, in traveling for hoped relief anywhere, by

* 'Biographic Clinics: The Origin of the Ill Health of DeQuincey, Carlyle, Darwin, Huxley and Browning.' *Idem*, Volume II., George Eliot, George Henry Lewes, Wagner, Parkman, Jane Welch Carlyle, Spencer, Whittier, Margaret Fuller Ossoli and Nietzsche. By George M. Gould, M.D., Editor of *American Medicine*, Author of 'An Illustrated Dictionary of Medicine, Biology, etc.,' 'Borderland Studies,' 'The Meaning and Method of Life,' etc. Philadelphia, P. Blakiston's Son & Co., 1903, 1904.

'change of climate,' 'change of scene,' etc. Most of them tormented themselves all their lives in dieting, and two gave much of their life to the hydropathic delusion.* In every case the one fact stands out clearly, and it could be verified by any number of quotations, that their miseries were consequent directly and quickly upon use of their eyes in writing or reading, and yet not one of them, while repeatedly chronicling the fact with his own pen, ever caught a hint of the causal nexus."

Fully to appreciate the force of the evidence one must read the facts that Dr. Gould has patiently gathered not only from the narratives of biographers and relatives, but also from the letters and notes of the sufferers themselves. In Chapter I. of Volume II., which reproduces a paper upon 'Eye-strain and the Literary Life,' read before the Canadian Medical Association, the author summarizes and keenly analyzes the symptoms of these fourteen elect men and women. He points out the folly of attributing reflex symptoms to disease of the organ in which the distress happens to be manifested, thus treating the same person at different times for 'brain-fag,' for 'dyspepsia,' for 'neurasthenia,' or perhaps attributing the condition to 'pure cussedness.' He shows how, especially in the case of Nietzsche, a sensitive organism may be irritated almost to the point of madness by the continual torture following the attempt to use the eyes for work to which they are not adapted. The pity of it is that with suitable glasses—mark the word suitable—all this suffering might have been averted. Dr. Gould further shows that the chief and most poignant symptoms from which the subjects of his clinics suffered can, in at least ten of the cases, be reduced essentially to the symptom-complex now termed 'hemicrania' or 'migraine'—in ordinary language, 'sick headache.' Hence the frequent recurrence of gastric distress, distaste for food, nausea, vomiting, pain in the head—hence the frequent erroneous accusation of stomach, brain, nerves, liver—hence the frequent invocation of that indefinite scape-goat, 'biliousness.'

* Which is something far different from scientific hydrotherapy.—S. S. C.

The dependence of migraine upon eye-strain as an exciting cause in a large number, perhaps the largest number of cases can no longer be denied by the most doubting Thomas. The writer of this review placed himself upon record to that effect so long ago as 1892. It is true, however, and here we probably differ from Dr. Gould, that in order for the eye-strain reflex to take the form of this particular paroxysmal neurosis the individual must present that special type of organization in which the inhibition or, to use a broader term, the taxis, of the vaso-motor mechanism is deficient —a defect* usually inherited but sometimes acquired by unwise living or in sequel to some pathologic accident. Otherwise the persistently recurring disorder would be much more common than it is among those whose eyes present the very common faults of astigmatism and hyperopia, as likewise among myopes having high degrees of ametropia. Also, in individuals presenting vasomotor ataxia, other exciting causes, likewise, may provoke the attack of migraine, as of asthma, of hayfever, or of some other nerve-storm. Be this as it may, the relief of eye-strain, by guarding the powder from at least one of the sparks that threaten, prevents that particular explosion.

Dr. Gould's great merit lies not so much in his individual theory of the causation of migraine as in his directing strongly the attention of the medical profession and, it is to be hoped, of workers in literature and science who are not physicians, to the necessity for eyes and the relief of eye-strain by suitable glasses, with recorrection from time to time, as the refraction alters and the reflex disturbances recur; the other, and in some respects greater, being the importance of gathering all facts concerning the ill health of any individual into a comprehensive whole, rather than to consider detached fragments as things utterly apart. As the writer has elsewhere expressed the same thought, 'the spokes are

* From the physical standpoint a defect; but in my observation so frequently associated with marked artistic and intellectual ability, that I am not sure that in moderate degree it is less than an advantage to a writer, actor or public speaker. S. S. C.

many, but the hub is one.' This method applies indirectly even to pathologic accidents such as acute infections; but its direct bearing is of course upon what may be termed the basic condition of health or disorder.

Many ophthalmologists of high repute and many internists ('general physicians') of experience and authority concur in greater or less extent with the views that Dr. Gould puts forth, but others of equal standing, and among them many reviewers in the medical press, differ from him radically; and some have even sought to cast ridicule upon 'Biographic Clinics' and their author because of what are termed his 'extreme' assertions. Doubtless he is over-emphatic. He has an earnest and virile style and evidently feels deeply upon the subject he is treating. There can be no mistaking his earnestness or his meaning and there can be no doubt that he arraigns with some bitterness, not his brother practitioners, but the inertia or the blindness that has delayed their full acceptance of the great medical truth to which he calls attention and to the development of which Dyer, Weir Mitchell, Thomson and Norris, of Philadelphia, Martin, of Paris, and others, including Dr. Gould himself, have contributed importantly.

Nobody likes to be scolded in public, and Dr. Gould has not been wise in seeming to scold. Grant this, however, and the truth still remains true. Grant, moreover, that he is extreme in the statement of the truth—let us then forget the 'extremity' of the statement and remember the verity of the fact stated. Unquestionably it is a truth of vast significance. Unquestionably physicians have not yet fully realized that significance.

The great importance of the eyes in human life and work, or the complexity of the work demanded of the eyes by modern civilization, need not be dilated upon. Our early ancestors had greatest need of good distant vision, and their range was bounded only by the sky and by the horizon. We spend much of our time within narrow walls and beneath low ceilings; walls too narrow, ceilings too low, even in palaces. In addition, we read or write or sew or paint or do surgical operations or decipher cuneiform inscriptions or study palimpsests or set type or look through microscopes or work at machines of various kinds, demanding close sight and more or less constant accommodational effort. Few are born nowadays with natural optical apparatus perfectly adapted to the environment. Some are fortunate enough not to undertake just exactly those lines of endeavor that call for the greatest use or most delicate adjustment of the ocular mechanism. Moreover, in many cases a fair approximation to good refraction answers; a pair of glasses is obtained which more or less imperfectly corrects the error, and all goes well. There are many persons, however, in whom, whether from natural sensitiveness of temperament, from the complexity, obscurity or magnitude of the ocular defect, from the excessive amount of eye-work done, or from failure of general health rendering the whole organism more sensitive to peripheral irritation, neglect of the eye or happy-go-lucky correction will not serve. Eye-strain ensues; asthenopic reflexes of all kinds are set up and these may be as varied in kind or grouping as the number of organs in the body multiplied by the number of possible individual peculiarities, and then as the number of possible permutations among the figures thus obtained.

'Eye-strain,' it is to be added, does not mean exclusively, or even chiefly, strain of the external muscles of the eye. Muscular defects may or may not, as Dr. Gould contends, be dependent in every instance upon refractive error—that it is so in many instances must be admitted. In any event accommodational strain is the fact of greatest importance. Moreover, Dr. Gould asserts that astigmatism is, of refractive errors, the one causing greatest distress. This is borne out not only by the personal experience of the writer as a patient, but also by his observation as a physician and the reports of many oculists to whom he has referred patients presenting reflex symptoms. Nor can any, however small, amount of astigmatism safely be treated as the old French doctor is said to have advised his students to treat a cold in the head—'with contempt.' The smallest appreciable amount needs correction. Astigmatism imperfectly

corrected is astigmatism uncorrected; and it continues to excite reflexes—cerebral, muscular, cardiac, respiratory, digestional or what-not.

We should not like to be misunderstood as teaching that eye-strain is *fons et origo mali* to all the ills that flesh inherits; or even in every case of nerve exhaustion, headache or dyspepsia in students and writers. Neurasthenia, gout, indigestion, can develop in those whose eyes are emmetropic, or, if ametropic, have been skilfully corrected. Too much confinement, too little exercise, injudicious diet and other errors of temperament, work and habit may cause many and varied symptoms, in the entire absence of eye-strain. Nevertheless, it is to be admitted that even in cases of other fundamental origin an uncorrected or imperfectly corrected refractive error will aggravate or even precipitate the symptoms.

We are not willing to go so far as Dr. Gould in ascribing, for example, the final break-down of Nietzsche to eye-strain alone. Of two 'extreme' and untenable hypotheses concerning that brilliant unfortunate we prefer Gould's to Moebius's, but we accept neither. We have no third to offer, for the facts before us are not sufficient to warrant dogmatism. Certain it is, however, that much of Nietzsche's misery was due to eye-strain. True, his eyes were examined and treated, but in all probability there remained undiscovered or uncorrected some worrisome refractive error —for the Germans have yet much to learn of the art that owes so much to the science of great Germans. An odd or complicated astigmatism, possibly of low amount, may have eluded detection or there may have been failure to adjust properly glasses correctly prescribed, or the personal equation of the patient may not have been met skilfully—there are numerous possibilities; and one guess is as good or bad as another.

To sum up: Dr. Gould has conceived with the brain of a master thinker and inscribed with the pen of a ready writer two volumes of 'extreme' readability, interest and importance; on the whole wise in tone, always forceful, usually graceful, often elevated in diction; unfortunately marred now and again by useless acridity or unnecessary denunciation. He has shown that much, if not all, of the constant or recurring distress of a number of the leading spirits of the nineteenth century—distress otherwise mysterious and unaccountable —was in all probability due to refractive defects of the eyes and the consequent accommodational strain made necessary during work. It might, therefore, have been relieved in large part, if not entirely, by suitable glasses; and this is the great, but therefore simple, lesson for physician and for patient. In emphasizing this lesson the author has emphasized old and unappreciated truth; he has also added to the sum of truth. It is a work well worth the doing; a work certainly not inferior to the invention of a new staining fluid, the synthesis of a new hypnotic drug or the description of a new symptom-complex; a work, of which the true value will become more apparent as the years increase.

SOLOMON SOLIS COHEN.

SCIENTIFIC JOURNALS AND ARTICLES.

THE April number of the *Botanical Gazette* contains the following articles: Mary Ellen Bennett, under the title 'Are Roots Aerotropic'? has shown that the claim of Molisch can not be sustained by her numerous experiments. She also offers a solution for the curvatures of roots recorded by him and termed aerotropic. Aven Nelson in his fifth 'Contributions from the Rocky Mountain Herbarium' describes a large number of new species, chiefly from southern Utah and southern Nevada. Florence Lyon discusses 'The Evolution of the Sex Organs of Plants,' upon the basis of numerous very interesting cases of exceptional development of antheridia and archegonia that she has found, chiefly among Pteridophytes. Charles Robertson makes a suggestive contribution to the phylogeny of Angiosperms from the standpoint of his study of the problems of pollination. His contention is that the primitive Angiosperms were entomophilous, and that the anemophilous ones are metamorphosed entomophilous flowers, whose seemingly simple structures are degraded, not primitive. F. V. Coville dis-

cusses and figures 'Arcterica, the Rarest Genus of Heathers,' living on Bering Island. W. F. Ganong has begun a series of descriptions of 'New Precision-appliances for Use in Plant Physiology,' this first paper dealing with a clinostat and a portable clamp stand.

SOCIETIES AND ACADEMIES.

THE NATIONAL ACADEMY OF SCIENCES.

THE following papers were presented at the spring session held at Washington on April 19, 20 and 21.

E. L. NICHOLS and ERNEST MERRITT: 'On Fluorescence Spectra.'

JOHN TROWBRIDGE: 'Spectra of Gas at High Temperatures.'

THEODORE LYMAN, presented by JOHN TROWBRIDGE: 'Short Wave-Lengths of Light.'

H. W. MORSE, presented by JOHN TROWBRIDGE: 'Spectra produced by the Wehnelt Interrupter.'

GEORGE F. BARKER: 'Note on Radioactivity and Autoluminescence.'

R. S. WOODWARD: 'A Double Suspension Apparatus for determining the Acceleration of Gravity.'

R. S. WOODWARD: 'The Compressibility of the Earth's Mass required by the Laplacian Law of Density Distribution.'

HENRY L. ABBOT: 'The Disposition of Rainfall in the Basin of the Chagres.'

A. F. ZAHM, introduced by A. GRAHAM BELL: 'Surface Friction of the Air at Speeds below 40 Feet a Second.'

R. H. CHITTENDEN: 'Physiological Economy in Nutrition, with Special Reference to the Minimal Proteid Requirement of the Healthy Man.' A preliminary Report.

HENRY F. OSBORN: 'Recent Paleontological Discoveries by the American Museum Exploring Parties.'

HENRY F. OSBORN: 'Reclassification of the Reptilia.'

W. D. MATTHEW, submitted by HENRY F. OSBORN: 'Position of the Limbs in the Sauropoda.'

HORATIO C. WOOD, JR., presented by HORATIO C. WOOD: 'A Preliminary Report upon *Apocynum cannabinum*.'

ARTHUR T. HADLEY, presented by the HOME SECRETARY: 'Biographical Memoir of James Hadley.'

CHARLES L. JACKSON: 'Biographical Memoir of Henry Barker Hill.'

ALEXANDER GRAHAM BELL: 'The Multi-nippled Sheep of Beinn Bhreagh.'

SIMON NEWCOMB: 'Application of New Statistical Methods to the Question of the Causes Influencing Sex.'

C. S. PEIRCE: 'Note on the Simplest Possible Branch of Mathematics.'

THE AMERICAN CHEMICAL SOCIETY.

NEW YORK SECTION.

THE seventh meeting of the season was held April 8, at the Chemists' Club, 108 West Fifty-fifth Street. The following program was presented:

The Determination of Manganese as Sulphide and the Composition of the Pink and Green Sulphides: J. C. OLSEN.

Professor Olsen discussed the advantages of separating and determining manganese as sulphide. The method is only practicable, however, when the sulphide is obtained as the green modification which is larger grained than the ordinary pink sulphide and, therefore, settles more readily and is more easily filtered and washed. This is best accomplished by pouring the manganese solution into a boiling solution of ammonium chloride and ammonium sulphide.

On analysis the pink sulphide showed variable amounts of water. This was found to be due to the fact that it is a mixture of a gray sulphide which holds more than three per cent. of water and a red sulphide. This modification was obtained pure and was found to hold the same amount of water as the green sulphide, about three fourths per cent. The difference between the pink and green sulphide is held to be one of molecular structure, rather than of chemical composition or degree of hydration.

On the Combination of a Solvent with the Ions (preliminary paper): J. LIVINGSTON R. MORGAN and C. W. KANOLT.

Preliminary experiments were reported which show that by electrolyzing a solution of silver nitrate and pyridine in water, pyridine migrates with the silver and increases in concentration at the cathode, while it decreases at the anode. With cupric nitrate and water, dissolved in alcohol, water migrates with the copper ions and increases on the cathode and decreases at the cathode.

This indicates the presence in solution of combinations of the ions with the solvent to form complex ions, which break up at the electrodes. The results show only the difference in the amount of solvent carried by the two ions. The application of the law of mass action to one such equilibrium shows that by it van't Hoff's form of Rudolphi's empirical dilution law can be readily derived. Thus, if MA is the salt and S the solvent, we have

$$2MA + (X + 2y + Z)S = (\overset{+}{M}_2 \cdot \overset{+}{X}S) + 2(A \cdot \overline{YS}) + 2S,$$

and if C_S is the undissociated concentration and C_i that of one of the ions and z large compared to x and y, it follows that

$$C_i \frac{(2C_i)^2}{C_S^2} = 4\frac{C_i^3}{C_S^2} = \text{constant},$$

The authors call attention to the fact that in this way it is easy to account for the variation in the speed of migration of the ions with the dilution, the presence of solvent of crystallization and the variation in the value of n in the general empirical dilution law $C_i^n/C^s = \text{constant}$. It was observed that this takes nothing away from the theory of ionization, but, in fact, conditions only those portions of the theory which have hitherto failed to hold.

Thorium, Carolinium, Berzelium: CHARLES BASKERVILLE.

Professor Baskerville reviewed the history of thorium, and especially the recent work bearing upon the question of its complexity. The study of radioactivity of thorium preparations led to the conclusion that thorium itself is not primarily radioactive and that the radioactive substances existing in thorium as ordinarily prepared are far too small in quantity to influence the atomic weight values as reported. Discrepancies in atomic weight determinations led to the fractionation of thorium by means of phenylhydrazine. The investigation of the fractions thus obtained and of the so-called 'volatile thorium' has given evidence of the two new elements, carolinium and berzelium, which differ markedly from thorium in the densities and solubilities of the oxides and in the results of atomic weight determinations by the sulphate method. The purified thorium shows phosphorescence with ultraviolet light, while carolinium and berzelium do not.

Exhibition and Demonstration with Radium of 1,800,000 Activity and Actinium of 10,000 Activity and their Action upon Minerals and Gems: G. F. KUNZ.

Dr. Kunz showed a number of photographic prints made from specimens of pitchblende now in the possesion of the Imperial Museum of Vienna, and added to that collection in the years 1806, 1807, 1814 and 1853. There seemed to be no difference in the intensity of the radioactivity of the specimens recently found (within a year or two in the mines) and those that are fully one hundred years old. Another photograph shown was made in eight seconds by laying a diamond upon a photographic plate and holding a specimen of radium (300,000 activity) on the back. Actinium chloride made by Dr. Debeirne and radium bromide from the Curie laboratories, were exhibited and their effects upon diamond, kunzite and willemite were shown experimentally, as well as a number of illustrations of the penetrating power of the radium rays.

H. C. SHERMAN,
Secretary.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 358th meeting was held March 22. The election of Lieutenant William E. W. MacKinlay, U. S. A., was announced. The secretary read the notice of the 14th International Congress of Americanists which will be held at Stuttgart, August 18–24, 1904.

Professor Holmes gave an account of the successful archeological work in the West Indies in which Dr. J. Walter Fewkes is engaged this winter.

Dr. I. M. Casanowicz read a paper entitled 'The Scarab.' He gave a description of the beetle and spoke of the ideas of the ancients concerning the habits of this peculiar insect. The earliest scarabs are those of King Nebka, 3,000 B. C. They were in use for 3,000 years, and show the earliest sculpture and evidences of art. The scarab is essentially an Egyptian

gem as the cylinder is Assyrian. Among the funeral scarabs especially to be mentioned were those placed upon the heart of the dead; these were usually inscribed with passages from the book of the dead; they were worn by the living as ornaments and amulets, and the historical scarabs, as those of Amenophis, were of large size and covered with inscriptions recording royal deeds. The paper was discussed by Dr. Weston Flint.

'The Franco-Egyptian Medal,' was the title of a paper by Col. Paul E. Beckwith, of the Division of History in the National Museum. Col. Beckwith briefly described the Napoleonic expedition to the valley of the Nile and spoke of Champollion and other French men of science who gave undying luster to this otherwise disastrous campaign. Col. Beckwith gave a history of the issuing of a medal by Louis XVIII. commemorative of the Egyptian explorations and described figures of Egyptian divinities which appear on this remarkable work of art.

Professor W. H. Holmes read an illustrated paper on 'Significant Analogies between Pre-Columbian and Oriental Art.' Professor Holmes discussed the subject of the peopling of America from the east and placed on the screen a series of portraits of various peoples from India, Mexico and around the Pacific. The views showed a remarkable similarity of types between the continents as to external features. Professor Holmes spoke briefly on the latitudinal modifications of peoples. A series of views showing types of architecture and art following the same range were next shown. Professor Holmes pointed out the use of pyramids in both hemispheres and the efflorescence of decorative designs to cover surfaces, these designs both in Cambodia and Mexico arising from religion. There is, said Professor Holmes, sufficient reason for studying the problem of art in southeastern Asia, and in the light of our present knowledge one is led to feel that there may have been oversea contact between America and Asia at the period of the great Buddhist revival about 1,000–2,000 years ago.

In the discussion Dr. Casanowicz said that there is unity in the multiplicity of anthropological phenomena. Buddhist art at the time of Asoka was affected by Persian art which was itself influenced by Assyro-Babylonian culture, and these facts explain the transplanting and derivation of architectural and art forms. By establishing a connection between Hindu and aboriginal American art an unbroken chain, as it were, is formed.

Col. Flint spoke of the similarity of the dragons of Chinese mythology to those of Central America. Miss Alice Fletcher said that there is unity of race and of art culture based on psychical conditions, hence the continents touch.

Dr. Hrdlicka agreed with Professor Holmes as to the Asiatic influx to America, and, discarding language as a factor, said that somatologically there are many points of agreement between the entire Malay-Mongolian stock and the American aborigines. The main difficulty in identifying the Americans with the Malay-Asiatics was the old error of making from the Indian a 'red' race.

Walter Hough,
General Secretary.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

The 385th regular meeting was held Saturday evening, April 2, 1904. Henry Oldys spoke on 'The Use of Our Musical Scale by Birds.' He briefly sketched the history of music, and then analyzed examples of bird music, showing that, judged by modern standards, they take higher rank than such specimens of the music of ancient Greece and the early church as have been preserved. The evolution of the modern diatonic scale among various peoples, some of whom must have developed it independently—Egyptians, Chinese, East Indians, Papuans, Bushmen, Aztecs, Iroquois Indians, Bellacoola Indians (British Columbia), Greenland Eskimos, and many others—indicates that there is something in this particular combination of definite and mathematically related intervals that is peculiarly satisfying to the musical taste, a taste shared by man only with birds. As some birds exhibit other essentials of modern music—rhythm, melodiousness, symmetry, etc. —we should naturally expect them to use the

modern scale, another essential, and, therefore, the burden of proof is upon those that deny its use by them. Two instances were cited in which the same notes were taken down on separate occasions, in each of which the record was completely independent and the first was not in mind when the second was taken. A phonographic record of an Eskimo song secured on one of Lieutenant Peary's expeditions was presented to demonstrate the identity of the intervals used by the singer with those of the modern scale. In conclusion, a whistled imitation was given of a melodious and rhythmical song of a wood pewee, and it was remarked that the technical requirements of modern music observed in the construction of this song are far more wonderful than the use it makes of the intervals of the modern scale.

Wilfred H. Osgood spoke on 'The Caribou of Alaska,' giving an outline of the present state of knowledge of the subject and detailing his own experience with one of the still remaining herds. The caribou of Alaska are all of the barren-ground type and their specific or subspecific relationships are still very imperfectly understood. They are found in comparatively large numbers in three general areas—the Alaska Peninsula, the region between the Yukon and Tanana rivers, and northeastern Alaska between the Yukon River and the Arctic coast. They have been exterminated over a large part of their former range and are now being killed in large numbers for their flesh and hides. Their annual increase, however, is large and they might easily be preserved under very liberal shooting regulations provided these could be enforced. A number of small scattering herds were observed in the region between the Yukon and Tanana rivers near the town of Eagle. The habits of the animals and the methods of hunting them were described. Lantern slide views showing small herds of the animals and the character of the country inhabited by them were shown.

M. W. Lyon, Jr., read a paper presenting the results of a study of the existing hares, rabbits and pikas, based on skulls and skeletons mainly in the collection of the U. S. National Museum. The hares and rabbits, family Leporidæ, were shown to contain ten distinct genera, many of which have previously been recognized as subgenera. Two were pointed out as new. The pikas, family Ochotonidæ, were shown to contain a single genus, *Ochotona,* composed of three subgenera. The characters by which the groups are determined are found in the enamel pattern of the teeth, the form of the cervical and lumbar vertebræ, sterna, ribs, bones of the forearm, etc., in addition to characters of the skull. Regret was expressed that only very few skeletons were available for study and the desirability of securing at least one skeleton of each species of mammal in addition to numerous skins and skulls was emphasized.

M. C. Marsh read a paper on 'The Gas Disease in Fishes.' The subject was first investigated at the Bureau of Fisheries' station at Woods Holl, Mass. The sea water for the aquaria was forced by steam pumps into elevated tanks for a gravity flow. Leaks in the suction pipe allowed air to enter, which, upon passing through the pump, was forced into solution by the hydrostatic pressure. The water reaching the aquaria was supersaturated with atmosperic nitrogen, possibly also with oxygen. In this condition it was rapidly fatal to all adult fishes, death usually being due to gas embolism. The occurrence of the free gas in the blood vessels was explained as a precipitation due to the slight elevation of the temperature in the systemic circulation, the blood as it passed through the gills tending to supersaturate like the water. A hydrostatic pressure of about six pounds prevented all symptoms of the disease, presumably by raising the saturation point of the blood plasma. The water could also be rendered harmless by a deaerating process as by passing it through perforated pans and allowing it to fall through several feet in a shower of slender streams. The renewal of the suction pipe, preventing access of free air to the water under pressure, likewise did away with all manifestations of the disease.

WILFRED H. OSGOOD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE TITLES OF PAPERS.

The writer is quite at one with Professor H. H. Wilder in his interesting protest, which appeared in Science, March 18. No doubt all in their younger days have indulged in the same pleasure of lengthy titles. Masters in rejuvenated science did the same; *vide* Humphry Davy's papers at the beginning of the nineteenth century. Descriptive titles appear to have good reason for their use. Mere verbiage is objectionable in the presentation of any scientific fact or principle, be it in the title or in the body of the paper. Excusing limitative prolix titles, not strictly descriptive, on the plea of modesty, will not answer, as the writers of papers realize as well as the readers that no science is complete.

Perhaps my experience is not very different from that of others. Scientific literature probably keeps pace in the rate of production with modern novels. One neither cares nor is able to read all, but he would like to know what is going on. Some forty or fifty scientific journals are placed on my desk every thirty days. All deal more or less with that division of science, chemistry, to which I have the honor and pleasure of devoting my humble labors. Even a specialist in the narrowest sense can do better work if he know something of other fields of activity. The undersigned finds it literally impossible to read all the articles in his own branch, much less labor through those of cognate subjects; consequently he must depend upon the title or the attached author's name in order to make a wise selection. An exceedingly interesting and valuable paper is published by an author whom the reader happens not to know, the title does not tell enough, the article is long, life is short and one passes it by. Numerous other causes preventing the reading of papers come to mind, but do not require enumeration.

Those journals which consist solely of abstracts, not opinionated reviews, come near offering a solution to the problem. This brings out another tale of woe. Numerous complaints have been made of the failure on the part of abstractors, however conscientious they may have been, to give really what the author meant to emphasize. Therefore, the suggestion is pertinent that we have distinctive titles followed immediately by a condensed *'synopsis' made by the author.*

I am quite well aware that many papers in some journals have a *'conclusion,'* which one must hunt for, and such an arrangement is in accord with strict logic; but below is an explanatory paragraph the writer recently placed at the beginning of a series of some two dozen papers on work in a narrow field.

We shall adopt in reporting investigations upon the rare earths the plan of succinctly stating in an introductory paragraph the facts observed and conclusions arrived at. Those desirous of familiarizing themselves with the details may peruse what follows at leisure. Perhaps others may care to pursue a similar course. No doubt a wider dissemination of the actual results arrived at will come about and the labors of abstractors be lessened and more accurate. Expediency influenced literary style before the twentieth century.

The writer believes such practice will accomplish the objects aimed at by Mr. Wilder and himself, and is independent enough to continue it alone, unless the various editors are too strenuous in their objections.

Chas. Baskerville.
University of North Carolina,
March 22, 1904.

To the Editor of Science: It is curious that Mr. H. H. Wilder's article (Science, March 18, 1904) should follow immediately on Mr. F. H. Knowlton's protest against a particular solecism. The two represent different sides of the same subject. Theoretically we must all support Mr. Wilder's plea for brevity, and the broad principle governing Mr. Knowlton's warning against ambiguity should also find general acceptance. These two principles are combined in recommendation (4) of the British Association Committee on Zoological Bibliography and Publication, namely, 'that it is desirable to express the subject of one's paper in its title, while keeping the title as concise as possible.' The difficulty, of course, is to be both precise and concise.

Brevity.—Mr. Wilder's longest example contains only thirty-seven words, and is excused

by its date (1665) and by the fact that all except the first word really constitutes a subtitle. The British Association committee alludes to a title of recent date containing ninety-one words. Mr. Wilder's precepts are admirable, but the heading of this letter shows how even his example may be bettered. A certain leading society persists in prefixing the useless 'on,' and forces an author to entitle his paper 'On the Tears of the Crocodile' instead of 'Crocodile's Tears.'

Clearness.—Modesty, Mr. Wilder would suggest, made an author say, 'Some Contributions to our Knowledge of the Morphology of the Guyascutidæ,' instead of 'Guyascutid Morphology,' and that same modesty, presumably, forbade him to suppose that the casual biologist might not know what a guyascutid was, and made him keep to himself the precise nature of his contributions. The enormous number of generic names and their synonyms often makes it impossible for a reader to tell the subject of a paper from its title. A specialist on echinoderms turned out at night to hear a paper 'On the Structure of *Apiocystis*,' only to find that it was an alga (if my memory serves) and not the Silurian fossil of that name. When a paper was published on the fluid of the body cavity in a certain animal the whole staff of the largest natural-history museum was unable to say what kind of animal was meant. In such cases the explanatory word may lengthen the title, but it is fully worth the space. Mr. Knowlton's examples of ambiguity are not so bad as these, but bad enough. Even the best of them is not really free from doubt; for example, what would an American botanist understand by 'The Flora of the Coal Measures. An Ecological Study'? This reminds me that a geological bibliographer innocently placed in his slip-catalogue the title of a work on 'Anthracite Coal Communities.' He has since learned that this too is an 'Ecological' study, neither geological, nor paleontological, nor zoological, nor botanical.

In fine, let the man of words, whether modest or 'intoxicated with the exuberance of his own verbosity,' remember that 'Brevity is the soul of wit,' and let the epigrammatist make for himself no occasion to say, 'Brevis esse laboro, obscurus fio.' F. A. B.

MARGINAL AND RIDGE SCALES IN CEPHALASPIS AND DREPANASPIS.

In two or three of his recent articles on *Trematastpis,* Dr. William Patten has affirmed his belief, contrary to that of all other writers, in the existence of 'numerous pairs of jointed oar-like appendages' in certain fossil ostracophores. His latest paper, in the December number of the *American Naturalist,** is noteworthy for its development of the thesis previously advanced by him to the effect that *Cephalaspis* is provided with a 'fringe of jointed and movable appendages (25–30 pairs) along the ventral margin of the trunk.'

Happily, the author does not postulate the existence of imaginary organs, as was done in the case of *Trematastpis;* but this time actual, definite structures are pointed out, familiar to every one as marginal scales, and these receive the new name of 'fringing processes,' and are interpreted as appendages. Regarding these structures Dr. Patten states that 'there is little doubt that they are the antecedents of the lateral fold of vertebrates,' although in another paragraph it is remarked that 'whatever their significance may be, there is apparently nothing known in true fishes that is exactly comparable with them.'

The present writer can not agree with his esteemed friend that these marginal scales, as they are commonly called, are not precisely what their name implies, and fails to see anything remarkable about them, either in form, in attachment or in position. Dr. Patten is quite right in observing that they are marked with the same surface ornamentation as trunk scales, nor do they differ from the latter in any other respect except that their extremities are free. The identical structures, if occurring in the median line above or below, would be pronounced *ridge scales;* if along the fin margins, they would pass for *fulcra;* if along the angles of modern flat-bottomed fishes, for *marginal* or *lateral scutes.* It may be, in fact, regarded as a general

* 'On the Structure of the Pteraspidæ and Cephalaspidæ,' pp. 827–865.

tendency amongst both vertebrates and invertebrates with a flattened ventral surface to have the lateral or pleural margins produced into processes of some sort. *Cephalaspis* is but one of numerous instances that might be mentioned amongst fishes, and illustrations abound amongst trilobites and various lower invertebrates.

The paired condition of the marginal scales in *Cephalaspis* is without significance, being a necessary accompaniment of the flattened ventral surface. Were the body laterally compressed, we should probably find but a single row of median scutes, as in *Lasanius* and *Birkenia,* although even in the latter genus Dr. Traquair is of the opinion that they are paired. Fulcra, also, are often paired; and it must be remembered that even a typically unpaired structure like the anal fin may occasionally appear as double. That the structures called 'fringing processes' by Dr. Patten can be looked upon in the nature of appendages has been emphatically denied by Dr. Gaskell,* who has studied the actual specimens upon which our Dartmouth friend bases his conclusions. Jaekel, of Berlin, likewise fails to see that there is any evidence of appendages in these forms.† Hence it would appear that paleontologists are not unanimously in favor of deriving the lateral fold of vertebrates from marginal scales such as occur in *Cephalaspis.*

Drepanaspis.—For our knowledge of the organization of *Drepanaspis,* one of the most interesting Paleozic fishes brought to light within recent years, we are indebted almost exclusively to the dean of British paleichthyologists, Dr. R. H. Traquair. In an appreciative review of Traquair's recent memoir on the 'Lower Devonian Fishes of Gemünden,' published in no. 471 of this journal,‡ Dr. Bashford Dean takes issue with the original author regarding the orientation of the creature. It is stated by Dean that Traquair's reasons 'seem inadequate for distinguishing dorsal and ventral sides. In no specimen figured is the relation of the dorsal lobe of the tail shown convincingly to be continuous with the so-called dorsal aspect.'

Whatever may be thought of Traquair's figures, although his plate 2 seems to us conclusive enough, there can be no question about the originals, and those who have examined them attentively are compelled to admit the correctness of the Scottish author's interpretations. The dorsal ridge scales are larger than the ventral, and form a more extended series, beginning further forward and continuing further back than the ventral fulcra. Several specimens in the Edinburgh Museum have been pointed out to the present writer by Dr. Traquair in which this row of prominent ridge scales can be traced continuously from a point shortly behind the median dorsal plate to the tip of the dorsal lobe of the tail. The extent to which the caudal lobes are covered with fulcra is well shown in Pl. 4 and Pl. 1, Fig. 1, of the memoir in question, and their connection with upper and lower systems of body plates appears tolerably distinct.

C. R. Eastman.

Cambridge, Mass.

* *Journ. Anat. and Phys.*, Vol. 37, p. 198, 1903.

† *Zeitschr. deutsch. geol. Ges.*, Vol. 55, p. 84, 1903.

‡ Science, Vol. 19, p. 64, 1904.

SPECIAL ARTICLES.

ON THE FEASIBILITY OF MEASURING TIDES AND CURRENTS AT SEA.

The importance of measuring the rise and fall of the tide, and especially the direction and velocity of the current at points more or less remote from land, is obvious to any one. The following brief discussion of a few questions involved seems to show that such measurements, although rather costly, can probably be made in almost any body of water whose surface at times becomes reasonably calm; at any rate, it should generally be possible to measure the current.

It is here proposed to make use of a species of piano-wire sounding apparatus, in which the 'lead' consists of a large stone, or of a bag or box containing stones, which is attached to the sounding wire by means of a string or a finer wire. This weight when once cast is to remain immovable on the bottom and is not to be recovered. The wire drawn taut serves to indicate when the vessel

passes over the weight. The aim of the observers on board is to so manœuvre the boat that the wire shall become apparently vertical as many times as possible throughout the period of observation, and at each such time to note the depth of the water and positions of the floats. For small depths, verticality can be estimated sufficiently well by aid of a plumb line held alongside of the sounding wire. For greater depths, more accurate means must be provided, such, for instance, as a small telescope supplied with vertical sight wires and hung in gimbals, together with a mirror placed alongside of the sounding wire and likewise hung in gimbals. If a boat were to be used exclusively for such work, it should have, at the point of least motion, a well through which sounding operations could be carried on. Of course, means must be provided for securing nearly uniform tension at the time of taking a reading. In small depths the approximation to uniformity need not be very close.

Problem 1.—Ignoring the impulse of the current upon the wire, also the sagging due to the wire's weight, required the amount of error in height or depth and in position due to the want of verticality of the wire.

Obviously,

$$\text{Height error} = l - l\cos\phi_s = l \text{ versed sine } \phi_s,$$
$$\text{Position error} = l \sin\phi_s,$$

where l denotes the length of wire extending from the bottom to the surface, and φ_s, the small angle which it makes with the vertical at the time of reading. Giving to φ_s several values, we have

$\phi_s =$	$\frac{1}{4}°$	$\frac{1}{2}°$	$1°$
Height error =	0.000010	0.000038	0.000152
Position error =	0.004363	0.008726	0.017452
$\phi_s =$	$2°$	$5°$	
Height error =	0.000609	0.003805	
Position error =	0.034900	0.087156	

In depths not exceeding 100 fathoms, an error of 1 degree in verticality can not cause an error of more than 0.1 foot in height or depth.

Problem 2.—Ignoring the impulse of the current upon the wire, and supposing the (vertical component of the) tension at its upper end to be ν times as great as its weight in water, required the error in height or depth and in position when the wire is not exactly vertical.

Let φ_s denote the want of verticality at the surface and φ_b that at the bottom; then

$$\text{True depth} = a\,(\operatorname{cosec}\phi_s - \operatorname{cosec}\phi_b)$$

where

$$\cot\phi_b = \frac{\nu - 1}{\nu}\cot\phi_s$$

and

$$a = \nu l \tan\phi_s.$$
$$\text{Height error} = l - \text{true depth},$$
$$\text{Position error} = a\,[\log(\operatorname{cosec}\phi_s + \cot\phi_s) - \log(\operatorname{cosec}\phi_b + \cot\phi_b)].$$

If the wire is nearly vertical, we have the following approximate equations:

$$\text{True depth} = a\left(\frac{1}{\nu}\cot\phi_s - \frac{1}{2(\nu-1)}\phi_s\right),$$
$$a = \nu l\,(\phi_s + \tfrac{1}{3}\phi_s^3),$$
$$\text{Position error} = a\log\frac{\nu}{\nu-1} + \frac{a}{4}\left[1 - \left(\frac{\nu}{\nu-1}\right)\right]_2\phi_s^2.$$

By aid of these equations doubtful interpolations can be avoided.

Assuming $\nu = 5$ and an apparent depth (l) of 3,000 units, we have as errors corresponding to a few values of φ_s:

$\phi_s =$	$\frac{1}{4}°$	$\frac{1}{2}°$	$1°$
Height error =	0.035	0.143	0.571
Position error =	14.60	29.21	58.41

This shows that in a depth as great as 3,000 fathoms the upper end of the sounding wire should not deviate more than one half degree from the vertical if a tide of ordinary amplitude is to be determined.

Problem 3.—Ignoring the sag due to the wire's weight and assuming that the horizontal impulse of the current is the same for each vertical unit, required the error in height or depth and in position when the upper end of the wire is exactly vertical.

The wire forms the arc of a parabola with vertex at the surface and whose equation is

$$x = \frac{\mu y^2}{2T_s}.$$

This gives

$$\text{Position error} = \frac{\mu(\text{depth})^2}{2T_s} = \frac{\mu l}{2\nu w}$$

where μ denotes the impulse per unit length,

w the weight in water of a unit length of the wire, and T_s the tension at the upper end, $=\nu l w$; it is assumed that the wire is nearly vertical throughout its length. From rectifying the parabola, we obtain

$$\text{Height error} = \tfrac{1}{6}\frac{\mu^2}{T_s^2} l^3 = \tfrac{1}{6}\frac{\mu^2}{\nu^2 w^2} l.$$

Assume $\mu = 0.001$ lb., $\nu = 5$, $w = 0.003$ lb.; the position error will be $l/30$ and the height error $l/1350$. As will be noted below, $\mu = 0.001$ lb. and $w = 0.003$ lb., imply, for a steel wire, a velocity of about 0.6 foot per second. For smaller velocities μ/w will be much less. In deep water, with $\nu = 5$, we should not expect to generally find velocities such that the error in height due to the tidal current could exceed one part in 100,000, unless the law of resistance given below does not hold good for feeble currents. See velocities given near the end of this paper.

Problem 4.—Taking into account the weight of the wire and assuming that the horizontal impulse of the current is the same for each vertical unit, required the error in height or depth and in position when the upper end of the wire is exactly vertical.

The forces acting upon a length l extending downward from the surface, give

$$\frac{dx}{dy} = \frac{\mu}{T_s - wl}.$$

From this we obtain, to the third power of the small quantities $\mu y/T_s$, wy/T_s,

$$x = \frac{\mu}{T_s}\frac{y^2}{2} + \frac{w\mu}{T_s^2}\frac{y^3}{3} + \frac{w^2\mu}{T_s^3}\frac{y^4}{4},$$

as the equation of the curve, the origin being the point where the wire crosses the surface. This rectified gives

$$l = y + \frac{\mu^2}{T_s^2}\frac{y^3}{6} + \frac{w\mu^2}{T_s^3}\frac{y^4}{4}.$$

$$\therefore \text{ Position error} = \frac{\mu l^2}{T_s}\left[\tfrac{1}{2} + \tfrac{1}{3}\frac{wl}{T_s} + \tfrac{1}{4}\frac{w^2\mu l^2}{T_s^2} - \tfrac{1}{6}\frac{\mu^2 l^2}{T_s^2}\right],$$

$$\text{Height error} = \tfrac{1}{6}\frac{\mu^2}{T_s^2} l^3 + \tfrac{1}{4}\frac{w\mu^2}{T_s^3} l^4.$$

I have made numerous experiments for determining the force of the impulse of water upon slender cylindrical rods. The rods used were of steel and varied in diameter from 0.036 to 0.5 of an inch. The velocity ranged from 1 to 1½ feet per second. The experiments showed that the force is well represented by the expression

$$\zeta \frac{v^2}{2g} \gamma l d,$$

where v denotes the velocity of the water; γ, the weight of a cubic unit of water at the temperature of the stream; l, the length of the rod; d, the diameter; and ζ an empirical abstract number found to be 0.95, approximately, or about one half of the value (1.86) obtained from the experiments of du Buat and Thibault for the case of a plane perpendicular to the flow of the stream. In all cases where length is involved in the above expression, the same unit of length must be employed.

For sea water γ may be taken as 64 lbs., and the above expression gives as the force for each foot of rod or wire

$$0.995\ \zeta v^2 d = 0.945\ v^2 d$$

pounds, $= \mu$.

In a steel wire suppose $d = 0.003$ foot; the force of impulse per foot ($= \mu$) is

$$0.945\ v^2 d = 0.002835\ v^2,$$

while the weight per foot for wire immersed in sea water is 0.003 lb. ($= w$). Hence, for a wire of this diameter the force of the impulse of the water will equal the weight of the wire in water (*i. e.*, μ will be equal to w) when the velocity is a trifle more than 1 foot per second.

For a simple progressive long wave of amplitude A in a body of water whose depth is h, the maximum velocity of the water particles is

$$A\sqrt{\frac{g}{h}}.$$

Let $A = 1$ foot; then the velocities, expressed in feet per second, corresponding to various depths, are as folows:

$$\text{Depth} = \begin{cases} 5\ 10\ 25\ 50\ 100 \text{ fathoms,} \\ 30\ 60\ 150\ 300\ 600 \text{ feet.} \end{cases}$$

Velocity = 1.035 0.732 0.463 0.327 0.232 feet.

$$\text{Depth} = \begin{cases} 500\ 1000\ 2000\ 3000\ 4000 \text{ fathoms,} \\ 3000\ 6000\ 12000\ 18000\ 24000 \text{ feet.} \end{cases}$$

Velocity = 0.104 0.073 0.052 0.042 0.037 feet.

In deep water the meteorological current is often much stronger than the tidal; but as it has not the period of the latter, the measurement of the rise and fall of the tide and of the velocity of the flow and ebb could hardly be seriously affected by its presence.

The object of looking into the several sources of error has been to ascertain when the errors are small enough to be neglected rather than to attempt correcting for them in actual measurements. R. A. HARRIS.

February, 1904.

SEX DIFFERENCES IN THE SENSE OF TIME.

IN going over the results of a series of demonstration tests of the sense of time given to a mixed class recently, the returns from men and women were separately reduced, the summaries of which presented features of sex differentiation concerning which corroboration or revision on the part of others is sought through this note.

The test involved periods of time extending from a quarter of a minute to a minute and a half in duration. The intervals were filled in four ways: (1) The instructor read aloud to the class from a psychological work unfamiliar to its members; (2) the members of the class marked as rapidly as possible all the letter m's in a page of printed text; (3) the class waited in idleness for the period to pass by, refraining as far as possible from counting or other means of recording the lapse of time; (4) each person estimated as accurately as possible the period in question, using whatever method he had personally found most serviceable for the purpose. As there were fifteen men in the class, the tabulation of returns from the women was brought to a close when an equal number of judgments had been entered therein.

Only in the case of the one-minute period was estimation made under all four conditions mentioned. The results are presented in the following table, in which the signs plus and minus indicate respectively over- and under-estimation of the duration in terms of seconds, and the figures at the tops of the columns the series of conditions enumerated above:

	Period. One Minute.			
Sex.	1	2	3	4
Men.	+29	+1.3	+22	−3.5
Women.	+66	+27	+80	+24

Incidentally, the purpose of the test was to call attention to the differences in one's estimation of time under conditions (1) and (2), and similarly in the case of (3) and (4). The relation of the members of these two pairs to each other is made apparent in the table. It is also to be noted that with the exception of the first entry in column (4), the only minus quantity in the whole series of tests, the error is throughout one of pronounced over-estimation. This tendency is very much stronger in the women than in the men, the first point of contrast in the comparison of sex differences. For this period of time the constant errors of the two sexes stand in a ratio of one to four. The clearest indication that this over-estimation of short periods of time on the part of women is a persistent habit, and not due to variable factors in the conditions of experimentation, appears in the fourth column of the table. In the case of men, keeping tally of the passing seconds results in the elimination of the positive error and the appearance of a slight under-estimation. In the case of women, on the contrary, over-estimation still persists to the amount of two fifths of the period in question; in other words, their unit of measurement is much in defect of the objective period which it is meant to represent.

The results of the various other tests made in the same series are summed in the following table, in which the same general relations are presented as in the preceding group.

	One quarter Minute.		One half Minute.		One and One half Minute.	
Sex.	3	4	1	4	1	3
Men.	+ 6	+0.5	+30	+ 3	+19	+ 70
Women.	+17	+10	+33	+12	+73	+189

There is also to be considered in such a comparison as the present the average variations of the individual judgments of men and women respectively from objective accuracy, of which the formulation of their constant

errors affords no indication. These are given in the following tables, the numbers in which are, as before, in terms of seconds:

Period. One Minute.				
Sex.	1	2	3	4
Men.	32	18	25	11
Women.	68	41	86	36

	One quarter Minute.		One half Minute.		One and One half Minute.	
Sex.	3	4	1	4	1	3
Men.	8	2	30	8	26	70
Women.	18	12	35	18	73	189

In sum, the excess of general inaccuracy in the estimation of the given periods of time on the part of women, as compared with men, is no less marked than their tendency to over-estimation. The extremes of individual judgment are very great; for instance, estimation of the duration of the 1½ minute period under condition (3) ran as high as ten minutes. In the case of men the highest was three and one half minutes. The average error of judgment among the men, all periods included, was 45 per cent. of the value of the periods estimated; that of the women amounted to 111 per cent., or two and one half times that of the men.

The noting of these sex differences was incidental to the primary purpose of the test, and attention is called to them here in order that observations on the part of others may be brought into comparison with the results presented by this group of persons, all of whom had some acquaintance with psychological experimentation, but few any systematic training in laboratory methods. The writer would be glad to learn whether the judgments of children of the two sexes present a closer approximation in character than those embodied in the preceding tables; and, in case they do, whether any systematic test has been made of their progressive differentiation with advance in age.

Robert MacDougall.
New York University.

*THE NATIONAL PHYSICAL LABORATORY.**

The annual inspection of the National Physical Laboratory by the general board took place on March 18, when also a large number of gentlemen interested in physical and mechanical science accepted the invitation of Sir William Huggins, president of the Royal Society, and of Lord Rayleigh, president of the general board, to examine the work carried on by the institution at Bushy House. All the departments of the laboratory were thrown open to the visitors, who were free to go where they pleased, and who found Dr. R. T. Glazebrook, the director, and his assistants ready to give every explanation of the apparatus displayed and the purposes to which it was being placed. The report for 1903 contains full details of the work which was carried out during that year, and also an outline of the program for the present year. In the engineering department this includes a continuation of the research on wind-pressure and of that on the mechanical properties of nickel-steels, undertaken jointly with Mr. Hadfield; an inquiry into the specific heat of superheated steam on a large scale; the erection and testing of the new screw-cutting lathe, for which a special house has been built and which is to be used for making standard leading screws on behalf of the Standard Leading Screw Committee of the War Office; and the construction of a machine for determining the friction of bearing surfaces. In the physics department, among other things, the construction of a standard ampere balance, together with various electrical tests, is to be undertaken for the engineering standards committee; various methods of measuring temperatures between 1,400 C. and 1,800 C., and the suitability of different glasses for high temperature thermometry, are to be investigated; the standardization of the steel yard and nickel meter is to be completed, and the urgently required work of comparing an 'end' yard and an 'end' meter with the 'live' standards, and of calibrating the subdivisions of each, is to be undertaken; and an inquiry is to be initiated into the conditions in which the pentane lamp may be treated as a standard, and measurements made of the refractivity and absorption of various glasses used by opticians.

* From the London *Times*.

During last year the number of tests made in the engineering and physics departments was 1,330, and the fees received amounted to £350, a sum of £536 being also received for researches undertaken in the laboratory; in the nine months of 1902 during which those departments were open the tests numbered only 269 and the fees were £69. In addition, many applications were made for tests which the laboratory was unable to undertake, owing to lack of equipment; among these were tests on wire and wire ropes, on rubber, on the tensile strength of metals after special hardening, on cement and stone, on very high-speed anemometers, and on alternate-current instruments of all kinds. In the engineering department the need of a powerful testing machine was greatly felt, and work had constantly to be declined which would have been accepted if such a machine had been available.

But while the work of the laboratory has prospered, its financial position gives rise to grave anxiety. The receipts for 1903 were £10,200 and the expenditures £10,306, the deficiency thus being £106. In the preceding year the receipts were £9,314 and the expenses £9,235, the balance being £79. In addition, £1,036 was spent in 1903 on equipment out of the accumulations transferred from the Kew committee. Thus the laboratory is spending more than its income, and in the opinion of the executive committee a further increase of expenditure will be necessary in the present year. By drawing on the available balance of £2,379 it will be possible to go on for another year, but the committee feels that the time has come when the financial position must be reconsidered. This is the more necessary since the period for which the grant of £4,000 was originally made ends next September, though the Royal Society has arranged with the treasury that it shall continue till April, 1905, and that a scheme for the future shall be considered by the treasury. The committee holds that an increase of funds is necessary even to maintain the work as at present, and a further increase of work for which there is a demand is to be carried out. It also thinks that, for the sake of permanence, the positions of the senior members of the staff should be made more secure, and that the stipends now paid to the assistants—with one exception £200 a year—are not commensurate with the work and are insufficient to retain for long the services of suitable men, while in addition the staff is now too small. It points out that similar institutions in other countries obtain more assistance from the state; in particular, the Reichsanstalt in Berlin alone gets £16,000, and the annual grants to the various institutions at Charlottenburg, which together cover the ground covered by the National Physical Laboratory, comes to about £40,000.

THE BERMUDA BIOLOGICAL STATION FOR RESEARCH.

HARVARD UNIVERSITY and New York University again unite with the Bermuda Natural History Society in inviting zoologists and botanists to spend six weeks in the temporary biological station located, as last year, at the Flatts, Bermuda.

Venerable George Tucker, Archdeacon, president of the Bermuda Natural History Society.

Hon. W. Maxwell Greene, Consul U. S. A., vice-president of the Bermuda Natural History Society.

F. Goodwin Gosling, honorary secretary of the Bermuda Natural History Society.

E. L. Mark, director of the Zoological Laboratory, Harvard University.

C. L. Bristol, professor of biology, New York University.

The Bermuda Islands are about seven hundred miles southeast of New York. They are nearly due east from Savannah, due south from Halifax, and due north from Porto Rico, being about equidistant from these three points. Since their discovery, in the seventeenth century, they have belonged to Great Britain, which maintains an important naval and military station there.

The climate is mild during the whole year, not being subject to the extremes that are found either in the temperate or tropical regions. The summer temperature is rarely higher than 85° F., and the winter rarely below 50° F. In the summer light breezes are almost constant and help to make the climate quite as comfortable as at many seaside resorts.

The soil is very porous, so that there are no streams, all the fresh water used in the islands being rain water caught on white-washed stone roofs and stored in covered cisterns. Endemic malaria and tropical fevers are unknown. The roads are excellent, and bicycles are much used.

The marine fauna and flora are abundant and such as are characteristic of coral reefs. The experience of last summer shows that there are available for study a great many varieties of marine forms, and that most of them occur in great abundance. The plan adopted in 1903 of recording the precise locality in which different organisms were found will greatly aid the investigator in procuring such material as he may desire.

Bermuda is reached in about sixty hours from New York by the vessels of the Quebec S. S. Co., which leave pier No. 47, North River, foot of West Tenth Street. During June, July and August, S. S. *Trinidad* is scheduled to sail from New York on the following dates: June 4, June 18, July 2, July 16, July 30, August 13; and returning to leave Hamilton, Bermuda, on June 11, June 25, July 9, July 23, August 6, August 20 and September 3.

By special arrangements with the Quebec S. S. Co., and the Hotel Frascati, the total expense of transportation from New York and return, and for board and lodging—but not washing—for six weeks at Bermuda, will be one hundred dollars. Board and lodging in excess of the period of six weeks will be charged for at the rate of ten dollars per week, but no arrangement will be made for a period of less than six weeks. This price is based on the understanding that two persons will occupy a room together. The payment of one hundred dollars entitles the applicant to the privileges of the laboratory and ample facilities for collecting and studying the animals and plants of the coral reefs, lagoons and shores.

The laboratory is a new and well-constructed building, and is furnished with all the ordinary glassware, reagents and apparatus provided in modern marine laboratories; but microscopes, dissecting instruments, slides and coverglasses are not supplied by the station. The means of collecting include a steam launch forty-five feet long and crew, a fish-well sailboat and crew, row-boats, a two-horse carriage carrying ten or twelve persons, nets, seins, water glasses, towing and dredging apparatus, etc.

The postoffice address of the station is Flatts, Bermuda.

Zoologists and botanists who desire to take advantage of the opportunities offered by the station should send applications as early as possible, and not later than June 1, either to Professor E. L. Mark, 109 Irving Street, Cambridge, Mass., or to Professor C. L. Bristol, New York University, University Heights, New York City. Applicants not officially connected with any scientific institution, or with any university or college in the capacity of instructors, should send letters of endorsement from those under whom they have studied. Applications should in all cases state the nature of the work proposed, and if possible the precise problem or problems contemplated. It will be possible in some cases to provide the use of books and monographs, if applicants indicate those which they desire but can not themselves procure. It should be understood that the opportunities offered are for investigations and that no formal instruction will be given. Each application should be accompanied with the sum of fifty dollars. If the application is accepted, a ticket and state-room assignment will be promptly forwarded to the applicant. Otherwise the fifty dollars will be returned. The remaining fifty dollars is to be paid upon arrival at Bermuda. No reduction from the sum named (one hundred dollars) can be made for any cause.

The date of sailing from New York is July 2. If a change in this date is necessitated by any change in the schedule of the Quebec S. S. Co., timely notice will be sent to every applicant.

Biologists who intend to take away from Bermuda collections, should ship to Bermuda their own alcohol, formol and cans for transporting specimens. Tax-free alcohol can be exported from the United States, a certificate of landing in Bermuda being all that will be

required in addition to the dealer's bond. The Quebec S. S. Co. agrees to charge for transportation only one-half its regular tariff rate on all scientific collections, apparatus, equipment, etc., both from New York to Bermuda and from Bermuda to New York.

Drafts on New York, gold coin and bank notes are current in Bermuda at $4.80 to the pound sterling; silver coin is not current.

If further information is desired, inquiries may be addressed to either of the undersigned.

E. L. MARK,
C. L. BRISTOL.

April 1, 1904.

SCIENTIFIC NOTES AND NEWS.

AT the meeting of the National Academy of Sciences last week members were elected as follows: Professor William Morris Davis, Harvard University; Professor William Fogg Osgood, Harvard University; Professor William T. Councilman, Harvard Medical School; Professor John U. Nef, University of Chicago. The foreign associates elected were: Professor Paul Ehrlich, Frankfurt; Professor H. Rosenbusch, Heidelberg; Professor Emil Fischer, Berlin; Sir William Ramsay, London; Sir William Huggins, London; Professor George H. Darwin, Cambridge; Professor Hugo de Vries, Amsterdam; and Professor Ludwig Boltzmann, Vienna. The Draper gold medal was presented to Professor George E. Hale, of the Yerkes Observatory, Wisconsin, for his researches in astrophysics.

THE Station for Experimental Evolution of the Carnegie Institution has established the class of associates including biologists of this country who are engaged in work in experimental evolution and who receive especial assistance from the Carnegie Institution or its station for this work. The station and its associates will work in a cooperative way, especially in the exchange of material for investigation. The following have become associates of the station for the year 1904: Professor N. L. Britton, New York Botanical Garden; Professor W. E. Castle, Harvard University; Professor H. E. Crampton, Columbia University; Professor D. T. MacDougal, New York Botanical Garden; Professor E. L. Mark, Harvard University; Professor W. J. Moenkhaus, Indiana University; Professor W. L. Tower, University of Chicago; Professor E. B. Wilson, Columbia University.

THE Prussian gold medal for science has been presented to Professor Wilhelm Hittorf, the eminent physicist and chemist, on the occasion of his eightieth birthday.

M. C. E. Bertrand has been elected a corresponding member of the Paris Academy of Sciences in the section of botany.

MISS N. M. STEVENS, A.B. (Stanford), Ph.D. (Bryn Mawr), has been appointed Carnegie research assistant and reader in experimental morphology at Bryn Mawr College.

ASSOCIATE PROFESSOR GEORGE C. PRICE, of the department of physiology of Stanford University, who has been in Europe on his sabbatical leave of absence, recently arrived in Boston, where he will spend the next three months at work in the embryological laboratory of Professor C. S. Minot of the Harvard Medical School.

PROFESSOR G. N. CALKINS, of Columbia University, will spend the summer abroad, visiting zoological laboratories.

MR. RAYMOND S. DUGAN, formerly assistant to Professor Todd, in Amherst College Observatory, later for three years in charge of the Beyrout Observatory and now assistant to Dr. Max Wolf in Heidelberg, has discovered a new planet which he has named Amherstia, in honor of his Alma Mater. Mr. Dugan graduated at Amherst College in 1899.

THE annual congress of French learned societies met at the Sorbonne, Paris, beginning on April 5. M. Levasseur presided.

THE congress of the French societies of geography was held at the beginning of the present month at Tunis under the presidency of M. Pichon.

DR. BOWDLER SHARPE, of the British Natural History Museum, has lately returned to England with some rare specimens of birds from the Cayman Islands.

DR. M. MIYAJIMA, instructor in the Imperial Hygienic Institute of Tokyo, has reached St. Louis to supervise the installation of the ex-

hibit of tetanus germs and other bacilli to be made by the institute.

Dr. H. W. Wiley delivered a lecture at Lehigh University on April 15, on the 'Work of the Bureau of Chemistry,' and before the Sigma Xi Society of Yale University on April 16, on 'Food Adulterations and how to Study their Effects.' After the lecture a smoker was held at the Graduates Club.

Professor E. Rutherford, of McGill University, lectured on 'Radium' to a large audience at the Ohio State University on April 12. The lecture was given under the auspices of the Society of the Sigma Xi.

Sir Henry Thompson, the distinguished surgeon, has died at the age of eighty-four years.

The Carnegie Institution has made a grant of $1,500 in continuation of last year's grant aiding the new reduction of Piazzi's 160,000 star observations. This work, under the direction of Dr. Herman S. Davis, Gaithersburg, Md., is now well advanced, previous assistance having also been rendered by Miss Bruce and by the National Academy of Sciences which continues its aid. A reobservation of all the southern stars of Piazzi's catalogue by Professor Tucker has recently been issued as Vol. VI. of the *Lick Observatory Publications* and a similar work for all the northern stars by Professor Porter will be an early publication of the Cincinnati Observatory. Other cooperators, both in this country and in Italy, are expected to complete the entire work in five years or less. It has now been in continuous progress nearly eight years.

A bill is before Congress appropriating one million dollars to be used in the erection of a building for the United States Geological Survey.

Plans have been prepared for a new hospital for New York City to cost $11,000,000.

The State Cancer Laboratory at Buffalo will receive its annual appropriation of $15,000 from the New York legislature. The chairman of the senate finance committee, who cut the item out, finally agreed that it be retained in the supply bill.

The large collection of North American Diptera which was presented to the American Museum of Natural History recently by Professor William M. Wheeler, curator of invertebrate zoology, has been combined with the collection formerly the property of the museum and is ready for use by students.

UNIVERSITY AND EDUCATIONAL NEWS.

The Iowa legislature has made the following appropriation:

IOWA STATE COLLEGE.	
Annual support fund	$50,000
Iowa Agrl. Exp. Station, annually	15,000
Engineering Experiments	6,000
For the completion of the central bldg	95,000
For central heating plant	54,500
For good roads experimentation	7,000
For dairy building and equipment, and farm	84,500
For additional support for repair fund, annually	4,500
IOWA STATE UNIVERSITY.	
Annual support fund	$25,000
For the repair and contingent fund, annually	7,500
$143,000 divided as follows:	
Library	20,000
Equipment and supplies	20,000
Paving for tunnel and extension	18,000
Land	25,000
Engineering building	50,000
For dam and water power	10,000
IOWA STATE NORMAL SCHOOL.	
Annually hereafter, increase support fund	$35,000
For the following purposes ($13,000):	
Librarian and two assistants for library	5,000
Improvement of grounds	3,000
For fuel, engineer and fireman	5,000

At the recent convocation of the University of Chicago, President Harper acknowledged a gift of $5,000 for special investigation in the department of physics, by the president of the Board of Trustees, Mr. Martin A. Ryerson, and a gift of $10,000, by Miss Helen Snow as a memorial to George W. Snow, her father, to rebuild the horizontal telescope at Yerkes Observatory, which was injured by fire.

Dr. Thomas L. Watson, since 1901 professor of geology in Denison University, has resigned to accept the chair of geology in the Virginia Polytechnic Institute, at Blacksburg, Virginia.